DOCUMENT RESUME

ED 172 027 CE 022 049

TITLE	Occupational Outlook Book, 1978-79 Edition. Bulletin No. 1955.
INSTITUTION	Bureau of Labor Statistics (DOL), Washington, D.C.
PUB DATE	78
NOTE	833p.; For a related document see CE 017 879 ; Parts may not reproduce clearly
AVAILABLE FROM	Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 (Stock No. 029-001-02067-8, Cloth Cover; No. 029-001-02059-7, Paper Cover)
EDRS PRICE	MF05 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Career Opportunities; Cluster Grouping; Employment Opportunities; Employment Patterns; *Employment Qualifications; *Employment Trends; *Job Market; Job Search Methods; Job Skills; Job Training; Labor Force; Labor Market; Labor Supply; Manpower Needs; Occupational Clusters; *Occupational Information; Occupational Surveys; Promotion (Occupational); *Salaries; Trend Analysis; Work Environment
IDENTIFIERS	United States

ABSTRACT

This handbook is divided into four major sections with the first section serving as a guide to the handbook. This introductory section tells how to use the handbook, where to go for more career information, how employment projections are made, and where tommorrow's jobs will be. The outlook for occupations in section 2 contains 300 occupational briefs grouped into thirteen clusters of related jobs. Clusters include occupations in areas such as industrial production; office occupations; service occupations; sales; transportation; scientific and technical occupations; mechanics; health occupations; social areas; and art, design, and communication occupations. For each specific occupation listed, information is given on the nature of the work, training requirements and other qualifications, opportunities for advancement, and expected earnings. The third section contains brief discriptions of thirty-five major industries. Major industry areas discussed are agriculture, mining and petroleum, construction, manufacturing, transportation, wholesale and retail trade, finance, service industries, and government. The fourth section provides an index of job titles by "Dictionary of Occupational Titles" code. An alphabetical index to occupations and industries found in the handbook is also included. (LRA)

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Occupational Outlook Handbook, 1978-79 Edition

U.S. Department of Labor
Ray Marshall, Secretary

Bureau of Labor Statistics
Julius Shiskin, Commissioner
1978

Bulletin 1955

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION

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Pointers on Using the Handbook

To locate a particular occupation or industry, see:
Table of Contents, page ix.
Dictionary of Occupational Titles Index, page 789.
Alphabetical Index, page 800.

4th edition Dictionary of Occupational Titles is in print.
This Handbook uses 3rd edition codes because many users haven't yet received the new edition of the D.O.T. For a conversion table comparing 3rd and 4th edition D.O.T. codes, see page 800.

For an overview of job prospects to 1985, read the section on Tomorrow's Jobs starting on page 19.

How do economists forecast the future?
For a brief description of the assumptions and methods used in preparing BLS employment projections, see page 17.

Does "keen competition" mean it's impossible to get a job?
To learn what the employment outlook section of each Handbook statement means, see page 5.

Looking for more career information?
Consult the Sources of Additional Information at the end of each statement. For career information for special groups in the labor force—youth, women, minorities, older workers, handicapped persons, and veterans, see page 11.

You need local information, too.
The Handbook gives information for the Nation as a whole. For a list of State employment security agencies that can provide information on local job prospects, see page 15.

Reprints are available.
For instructions on ordering one or more of 42 reprints, see page 819.

Other BLS materials useful to Handbook readers are listed on page 824.

Subscribe to the
OCCUPATIONAL OUTLOOK QUARTERLY,
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It keeps you up to date on fast-changing employment trends.

It reports promptly on new occupational research results.

It analyzes legislative, educational, and training developments that affect career planning.

Order form on back cover.

Foreword

The difficulties young people experience when making the transition from school to work has been recognized by leaders in government and education as a serious national problem. One way to help ease this transition is to provide young people with accurate and comprehensive career guidance information. By acquiring specific knowledge of the various occupations in our economy, they can become aware of the opportunities and alternatives that are available to them, and can plan for careers suited to their abilities and aspirations.

The *Occupational Outlook Handbook* is a major source of vocational guidance information for hundreds of occupations. For each occupation, the *Handbook* describes what workers do on the job, the training or education needed, and most importantly, some idea of the availability of jobs in the years ahead.

Although many people who need career guidance information are young, such as students facing the transition from school to work, the *Handbook* also is a useful resource for those entering or reentering the work force at later stages in their lives. The process of vocational choice and preparation may be accompanied by anxiety and uncertainty regardless of when in the life cycle it occurs. Our hope in the Department of Labor is that this publication will continue to offer valuable assistance to all persons seeking satisfying and productive employment.

Ray Marshall, Secretary of Labor

Prefatory Note

In our constantly changing economy, information on future career opportunities and educational requirements is necessary if workers are to be prepared for tomorrow's jobs. For more than 30 years, the Bureau of Labor Statistics has conducted research on occupations and industries for the purpose of providing this information for use in vocational guidance.

The major product of this research is the *Occupational Outlook Handbook*, which contains information on job duties, educational requirements, employment outlook, and earnings for several hundred occupations and 35 industries. The *Handbook* information is based on data received from a variety of sources, including business firms, trade associations, labor unions, professional societies, educational institutions, and government agencies, and represents the most current and comprehensive information available.

This edition of the *Handbook* has been revised to enhance its usefulness. Many statements contain expanded information on occupational training; some include information on the movement of workers from one occupation to another and typical paths of advancement within a career field. The new *Handbook* also contains a *Dictionary of Occupational Titles* index, referenced to the third edition of the *Dictionary* and cross referenced to the fourth, and most recent edition.

Julius Shiskin, Commissioner, Bureau of Labor Statistics

Letter of Endorsement

Work can be one of life's most rewarding experiences. A job can offer pride in achievement and an opportunity for personal growth, as well as the security of an adequate income. But finding work that is satisfying seldom is easy. Many individuals make several different career choices over time as their job needs and aspirations change. Career planning with the advice of trained counselors can help a great deal.

To assist individuals with their educational and vocational choices, counselors must have occupational information that is current, accurate, and comprehensive. The *Occupational Outlook Handbook* is a primary source of the information needed for sound career planning. For several hundred occupations and 35 major industries, the *Handbook* describes what workers do on the job, the training and education required, advancement possibilities, employment outlook, and earnings and working conditions. Most statements also list professional societies, trade associations, unions, and other organizations that can supply additional career information.

Counselors in all work settings will find the new edition of the *Occupational Outlook Handbook* an invaluable tool for helping clients plan a satisfying future in the working world.

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Guidance Association

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Government Sources

Federal. Administration on Aging; Bureau of the Census; Bureau of Land Management; Bureau of Mines; Bureau of Prisons; Department of Agriculture; Department of Health, Education, and Welfare; Department of Labor; Department of the Navy; Employment and Training Administration; Energy Research and Development Administration; Federal Aviation Administration; Federal Bureau of Investigation; General Services Administration; Geological Survey; Government Printing Office; National Aeronautics and Space Administration; National Highway Traffic Safety Administration; National Institutes of Health; National Oceanographic and Atmospheric Administration; National Park Service; Office of Safety and Health Administration; U.S. Postal Service; and Veterans Administration.

State and Local. District of Columbia—Department of Human Resources, Fire Department, Police Department, and Public Library; Montgomery County Public Schools (Md.); Virginia—Department of State Police; and Washington (D.C) Metropolitan Area Transit Authority.

Private Sources

Membership Groups. Aluminum Association; American Chemical Society; American Chiropractors Association; American Dental Assistants Association; American Dental Hygienists Association; American Personnel and Guidance Association; American Home Economics Association; American Institute of Architects; American Medical Record Association; American Occupational Therapy Association; American Optometric Association; American Osteopathic Association; American Physical Therapy Association; American Psychological Association; American Society of Planning Officials; American Textile Manufacturers Institute; American Trucking Associations; Associated General Contractors of America; Association of American Geographers; Association of American Railroads; Association of Operating Room Technicians; Forging Industry Association; Gypsum Drywall Contractors, International; Motor Vehicle Manufacturer's Association; Music Educators National Conference; National Association of Barber Schools; National Association of Social Workers; National Electric Sign Association; Public Relations Society of America; Society of American Florists and Ornamental Horticulturists; Tile Contractors Association of America, Inc.; and United Auto Workers.

Industry and Business. Acacia Mutual Life Insurance Co.; American Airlines, Inc.; American Telephone and Telegraph Co.; Armco Steel Corp.; Associated Truck Lines, Inc.; Atlantic Richfield Co.; Bemar Service Pharmacy; Blake Construction Co.; Cannelton Industries, Inc.; Canteen Corp.; Captain Stan's Boat Center; Chessie System, Inc.; Cinderella Shoe Shop; Clarendon Bank and Trust; Consolidated Edison Co. of N.Y., Inc.; Deere and Co.; Del Monte Corp.; Garfinkle, Brooks Bros., Miller and Rhoades, Inc.; General Dynamics Corp.; General Electric Co.; General Motors Corp.; Getty Oil Co. (Eastern Operations), Inc.; Georgia-Pacific Co.; Girard Bank; Goodyear Tire and Rubber Co.; Grand Union Co.; Greyhound Corp.; Grumman Corp.; Hilton Hotels Corp.; Hoffman Interiors, Inc.; Household Finance Corp.; Hyatt-Regency, Washington, D.C.; Industrial Publishing Co.; ITT Sheraton Corp.; Inland Steel Co.; International Business Machines Corp.; Jones Opticians; Jordon Kitt Co.; Kaiser Industries Corp.; Lebow Bros. Co.; Lynchburg Foundry Co.; Marine Midland Bank, Inc.; Marriott Corp.; McDonnell Douglas Corp.; McNally Pittsburg Mfg. Co.; Melart Jewelers; Merck and Co., Inc.; Merkle Press, Inc.; Monsanto Co.; NCR Corp.; National Broadcasting Corp. Inc.; Northwest Ford Co.; Ober Travel Agency; Orkin Exterminating Co.; Oster Corp.; Ottenberg's Bakery; Philadelphia Electric Co.; Rochester Gas and Electric Corp.; Royce TV Repair Services; Santa Fe Industries, Inc.; Southern Railway Co.; Sun Co., Inc.; Thompson and Litton, Inc.; T. I. Swartz Co.; Unilux, Inc.; United Air Lines, Inc.; Ventura Jewelers Co.; Washington Post Co.; Weber's White Trucks, Inc.; Weyerhaeuser Co.; and Woodward and Lothrop, Inc.

Publications. *Baltimore Jewish Times; Catholic Standard; Contractor Magazine; Farm and Power Magazine; Marketing News; and Women's Wear Daily*.

Schools. California Institute of Technology; California College of Pediatric Medicine; Cape Fear Technical Institute (N.C.); Carnegie-Mellon University; Georgetown University Medical Center; Kansas State University; Miami-Dade Junior College (Fla.); Montgomery County Public Schools (Md.); Towson State University (Md.); University of Delaware; and University of Maryland.

Other. Children's Memorial Hospital of Chicago; Holy Cross Hospital (Silver Spring, Md.); Lutheran Council in the United States of America; Peggy Kauders; United Nations; Washington Hospital Center (D.C.); and WMAR-TV (Baltimore, Md.).

Note

A great many trade associations, professional societies, unions, and industrial organizations are able to provide career information that is valuable to counselors and job seekers. For the convenience of *Handbook* users, some of these organizations are listed at the end of the statements on individual occupations and industries. Although these references were assembled carefully, the BLS has neither authority nor facilities for investigating the organizations listed. Also, because the Bureau does not preview all the information or publications that may be sent in response to a request, it cannot guarantee the accuracy of such information. *The listing of an organization, therefore, does not constitute in any way an endorsement or recommendation by the Bureau or the U.S. Department of Labor, either of the organization and its activities or of the information it may supply*. Each organization has sole responsibility for whatever information it may issue.

The occupational information contained in the *Handbook* presents a general, composite description of jobs and industries and cannot be expected to reflect work situations in specific establishments or localities. *The Handbook, therefore, is not intended and should not be used as a guide for determining wages, hours, the right of a particular union to represent workers, appropriate bargaining units, or formal job evaluation systems*.

Comments about the contents of this publication and suggestions for improving it are welcome. Please address them to Chief, Division of Occupational Outlook, Bureau of Labor Statistics, U.S. Department of Labor, Washington, D.C. 20212.

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Guide to the Handbook

What's in the Handbook?

- Introductory sections that tell how to use the Handbook, where to go for more career information, how employment projections are made, and where tomorrow's jobs will be.
- 300 occupational briefs, grouped into 13 clusters of related jobs
- 35 industry briefs
- Index of job titles by *Dictionary of Occupational Titles* code
- Instructions for ordering Handbook reprints, the *Occupational Outlook Quarterly*, and other BLS publications that will keep you informed about the economy and the job market.

HOW TO USE THE HANDBOOK

How many kinds of jobs are there?

Several hundred occupations are described in the *Handbook*, although the total number of occupations in the U.S. economy may be counted in the thousands. Most occupations requiring long periods of education or training are discussed, as are a number of small but growing fields of employment. Altogether, the occupations in the *Handbook* account for about 95 percent of all salesworkers; about 90 percent of professional, craft, and service workers; 80 percent of clerical workers; 50 percent of all operatives; and smaller proportions of managerial workers and laborers. The main types of agricultural occupations are described in the *Handbook*. The long-term job outlook for the Nation as a whole is discussed, too.

Where should I look first?

Start with what you know about your own interests and abilities. Do you like frequent contact with other people or do you prefer to spend a lot of time alone? Are you a good follower or someone whose greatest rewards come from directing others in a work effort? The answers to these and similar questions can help you assess the personal traits and individual aptitudes that influence your job satisfaction and performance. It may be useful to discuss your personal needs and abilities with a counselor trained in exploring human behavior. He or she is familiar with tests and other methods for making this unique, personal assessment.

The next step is to match your individual talents and goals with those demanded by various fields of work. You may have discovered, for example, that one of your strong needs is frequent interaction with people so that social service work seems appealing. To find out what kind of jobs there are in that field, consult the *Handbook's* Table of Contents under Social Service Occupations. All of the occupations in the *Handbook* are arranged in "clusters" of related jobs. There are 13 clusters altogether: Industrial production, office, service, education, sales, construction, transportation, scientific and technical, mechanics and repairers, health, social science, social service, and art, design, and communications occupations. Most career clusters in the *Handbook* describe a variety of jobs in a single field of work. Training and skill requirements within a particular cluster often vary a great deal. If you are thinking about a future in health work, for example, you will find that a few jobs in the health occupations cluster require only a high school diploma; others require a degree from a 2-year community college or junior college; still others require a bachelor's degree; and a few require 4 years or more of formal training following college graduation.

If you know initially that the length or type of career training open to you is restricted by your own financial limitations or family obligations, you may want to narrow your job choices to those requiring high school or 2-year college preparation. The Bureau of Labor Statistics has prepared several pamphlets, based on information in the *Handbook*, that classify and describe selected jobs by the type and length of training required. Looking first at the appropriate pamphlet from this series, such as *Jobs for Which a High School Education is Required*, may be an efficient way to narrow your career choices to those that are realistic for you. See the section on BLS Publications Useful to Handbook Readers for a list of the pamphlets in the *Jobs for Which* Series and information on how to obtain them.

You may already have a specific job or industry in mind. Or, if an important industry is located in your area, you may find it useful to read the *Handbook* industry statement to learn about the different jobs in that industry and their varied training requirements and earnings potential. To find out where it is described, turn to the Index of Occupations and Industries at the back of the book. There are 36 industry statements in the *Handbook*, grouped according to major divisions in the economy: Agriculture, mining, and petroleum; construction; manufacturing; transportation, communications, and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government.

What will I learn?

Once you have chosen a place to begin—an occupation or industry you'd like to learn more about—you can use the *Handbook* to find out what the job is like, what education and training are necessary, and what the advancement possibilities, earnings, and employment outlook are likely to be. Each section of the *Handbook* follows a standard format, making it easier to compare different jobs. What follows is a description of the type of information presented in each *Handbook* statement, with a few words of explanation.

The numbers in parentheses that appear just below the title of most *Handbook* statements are *D.O.T.* code numbers. D.O.T. stands for *Dictionary of Occupational Titles*, now in its fourth edition, a U.S. Department of Labor publication which "defines" each of about 20,000 jobs according to a system that uses numbers to classify each job by the type of work performed, training required, physical demands, and working conditions. Because many *Handbook* users have not yet received the recent fourth edition of the D.O.T,

the D.O.T number accompanying each statement in this Handbook refers to the previous, third edition of that volume. A conversion table showing the fourth edition number that corresponds to that from the third edition, used in the *Handbook*, appears in an Appendix. An index listing *Handbook* occupations by D.O.T. number precedes the alphabetical Index of Industries and Occupations. D.O.T. numbers are used primarily by public employment service agencies for classifying applicants and job openings, and for reporting and other operating purposes. They are included in the *Handbook* because career information centers and libraries frequently use them for filing occupational information.

The **Nature of the Work** section describes the major duties of workers in the occupation. It tells what workers do on the job and how they do it. Although each job description is typical of the occupation, duties are likely to vary by employer and size of employing organization, geographic location, and other factors. In some occupations, individual workers specialize in certain tasks. In others they perform the entire range of work in the occupation. Of course, job duties continually change as technology advances, new industrial processes are developed, and products or services change.

The **Places of Employment** section provides information on the number of workers in an occupation and tells whether they are concentrated in certain industries or geographic areas. Whether an occupation is large or small is important to a jobseeker because large occupations, even those growing slowly, offer more openings than small ones because of the many workers who retire or die each year.

Some occupations are concentrated in particular industries. Most cooks and chefs, for example, are employed in the restaurant and hotel industries while secretaries are employed in almost every industry. If an occupation is found primarily in certain industries, this section lists them.

A few occupations are concentrated in certain parts of the country. Actors and actresses, for example, usually work in California or New York. This information is included for the benefit of people who have strong preferences about where they live—because they do not wish to be separated from their families and friends, for example. For most occupations, however, employment is widely scattered and generally follows the same pattern as the distribution of the population.

In addition, information on part-time employment is included because it is important to students, homemakers, retired persons, and others who may want to work part time. Knowing which occupations offer good opportunities for part-time work can be a valuable lead.

The **Training, Other Qualifications, and Advancement** section should be read carefully because the decisions you make concerning preparation for an occupation represent a considerable investment of time and money. Early and wise planning toward a career goal can save you unwarranted expenditures later. If you currently are in school, it's a good idea to look closely at the list of high school and college courses regarded as useful preparation for the career you have in mind. Nearly all *Handbook* statements list such courses.

Workers can qualify for jobs in a variety of ways, including college study leading to a certificate or associate degree; programs offered by postsecondary vocational schools, both public and private; home study courses; government training programs; experience or training obtained in the Armed Forces; apprenticeship and other formal training offered on the job or in the classroom by employers; and high school courses. For each occupation, the *Handbook* identifies which of these routes of entry is preferred. In many cases, alternative ways of obtaining training are listed as well. It is worth remembering that the level at which you enter an occupation and the speed with which you advance often are determined by the amount of training you have.

Many occupations are natural stepping stones to others. After working for a time as a programmer, for example, many people advance to jobs as systems analysts. The world of work is dynamic and few workers spend their lives in one or even two occupations. Some have several jobs over a lifetime, changing careers when it is advantageous to do so. Frequently observed patterns of movement from one occupation to another, such as advancement from programmer to systems analyst, are discussed in the *Handbook*. This type of information can be useful in several ways.

It is helpful to know, for example, that skills gained working at one job can make you more employable in another—perhaps a job that is more desirable in terms of earnings, working conditions, or scope for self-expression. On the other hand, it also is useful to know which jobs offer the most opportunity for transferring to other work of a similar nature. Persons trained in electrical or chemical engineering, for example, frequently can transfer to another engineering specialty where they can apply general engineering knowledge in different ways.

In some cases moving from one occupation to another takes more than the training or experience acquired on the job. Before a hospital aide can advance to licensed practical nurse, for example, ye or she must complete the year of specialized training required for licensing. Many *Handbook* statements describe the possibilities for advancement after additional training, and note any in-service programs that allow employees to gain needed skills while continuing to work part time. Certain occupations offer employment opportunities to persons with little or no previous work experience. The *Handbook* includes many statements on such entry level jobs, many in the office and service clusters.

It usually is wise, however, to discuss the patterns of job transfer and advancement described in the *Handbook* with counselors, local employers, and others who know about the particular job market where you want to work. Typical patterns of movement from one occupation to

another may not apply in every employment setting.

All States have certification or licensing requirements for some occupations. Physicians and nurses, elementary and secondary school teachers, barbers and cosmetologists, electricians and plumbers are examples of occupations that are licensed. If you are considering occupations that require State licensing, be sure to check the requirements in the State in which you plan to work.

An important factor in career choice is the extent to which a particular job suits your personality. Although it often is difficult for people to assess themselves, your counselor undoubtedly is familiar with tests that can help. Each statement in the *Handbook* provides information which allows you to match your own unique personal characteristics—your likes and dislikes—with the characteristics of the job. For a particular job, you may need the ability to:

—make responsible decisions.

—motivate others.

—direct and supervise others.

—work under close supervision.

—work in a highly competitive atmosphere.

—enjoy working with ideas and solving problems.

—enjoy working with people.

—enjoy working with things—good coordination and manual dexterity are necessary.

—work independently—initiative and self-discipline are necessary.

—work as part of a team.

—enjoy working with detail, either numbers or technical written material.

—enjoy helping people.

—use creative talents and ideas and enjoy having an opportunity for self-expression.

—derive satisfaction from seeing the physical results of your work.

—work in a confined area.

—perform repetitious work.

—enjoy working outside, regardless of the weather.

The **Employment Outlook** section discusses prospective job opportunities. Knowing whether or not the job market is likely to be favorable is important in deciding whether to pursue a specific career. While your interests, your abilities, and your career goals are significant, you also need to know something about the availability of jobs in the fields that interest you most.

Figure I

Description	*Projected 1976–85 change in employment requirements*
Much faster than the average for all occupations	50.0 percent or greater
Faster than the average for all occupations	25.0 to 49.9 percent
About as fast as the average for all occupations [1]	15.0 to 24.9 percent
More slowly than the average for all occupations	5.0 to 14.9 percent
Little change is expected	4.9 to −4.9 percent
Expected to decline	−5.0 percent or greater

[1] The average increase projected for all occupations for the 1976–85 period is 19.2 percent.

The employment outlook section of most *Handbook* statements begins with a sentence about expected employment growth through 1985. The occupation or industry is described as likely to grow about as fast as the average for all occupations or industries; faster than the average; or more slowly than the average (figure I). *Job opportunities in a particular occupation or industry usually are favorable if employment increases at least as rapidly as in the economy as a whole. Occupations or industries in which employment stays about the same or declines generally offer less favorable job prospects than those that are growing because the only openings are those due to deaths, retirements, and other separations from the labor force.*

Some *Handbook* statements take note of the effect of fluctuations in economic activity. This information is valuable to people looking into long-range career possibilities at a time when the economy is in a recession. Persons understandably wonder: What will the economy be like when I enter the labor market? Will it be harder to find a job 5 or 10 years from now than it is today? The *Handbook* gives information, wherever feasible, on occupations and industries whose levels of employment fluctuate in response to shifts in the economic climate. It is important to bear in mind that employment in many—but not all—occupations and industries is directly affected by an economic downturn. A sharp improvement in the outlook for these occupations and industries is likely as the economy picks up. However, other occupations and industries are less affected by short-term changes in economic activity. Other factors influence their growth or decline. These matters are explored in a number of *Handbook* statements.

For some occupations, information is available on the supply of workers--that is, the number of people pursuing the type of education or training needed and the number subsequently entering the occupation. When such information is available, the *Handbook* describes prospective job opportunities in terms of the expected demand-supply relationship. The prospective job situation is termed "excellent" when demand is likely to greatly exceed supply; "keen competition" when supply is likely to exceed demand. Other terms used in *Handbook* statements are shown in Figure II.

Workers who transfer in to one occupation from another sometimes are a significant component of supply; similarly, those who transfer out may have a substantial effect on de-

Figure II

Job opportunities	*Prospective demand-supply relationship*
Excellent	Demand much greater than supply
Very good	Demand greater than supply
Good or favorable	Rough balance between demand and supply
May face competition	Likelihood of more supply than demand
Keen competition	Supply greater than demand

mand because their leaving usually creates a job opening. Although the information currently available on transfers among occupations is limited, some statements in the *Handbook* discuss transfer patterns and their effect on the supply for certain occupations. The employment outlook for engineers, for example, notes that transfers into the field are likely to constitute a substantial portion of supply if past trends continue.

The information in this section should be used carefully. Getting a job may be difficult if the field is so small that openings are few (actuaries and blacksmiths are examples) or so popular that it attracts many more jobseekers than there are jobs (radio and television broadcasting, journalism, the performing arts, and modeling). Getting a job also can be difficult in occupations and industries in which employment is declining (merchant sailors, photoengravers, typesetters), although this is not always the case. But even occupations that are small or overcrowded provide some jobs. So do occupations in which employment is growing very slowly or even declining, for there is a need to replace workers who leave the occupation. If the occupation is large, the number of job openings arising from replacement needs can be quite substantial. Bookkeepers, telephone operators, and machinists are examples of large occupations that provide a significant number of job openings each year because workers leave. On the average, openings resulting from replacement needs are expected to account for nearly two-thirds of all job openings.

How reliable is the information on the outlook for employment over the next 10 years? No one can predict future labor market conditions with perfect accuracy. In every occupation and industry, the number of jobseekers and the number of job openings constantly changes. A rise or fall in the demand for a product or service affects the number of workers needed to produce it. New inventions and technological innovations create some jobs and eliminate others. Changes in the size or age distribution of the population, work attitudes, training opportunities, or retirement programs determine the number of workers available. As these forces interact in the labor market, some occupations experience a shortage, some a surplus, some a balance between jobseekers and openings. Methods used by economists to develop information on future occupational prospects differ, and judgments that go into any assessment of the future also differ. Therefore, it is important to understand what underlies each statement on outlook.

For every occupation and industry covered in the *Handbook*, an estimate of future employment needs is developed. These estimates are consistent with a set of assumptions about the future of the economy and the country. For more detail, see the section entitled, Assumptions and Methods Used In Preparing the Employment Projections.

Finally, you should remember that job prospects in your community or State may not correspond to the description of the employment outlook in the *Handbook*. For the particular job you are interested in, the outlook in your area may be better, or worse.The *Handbook* does not discuss the outlook in local areas because the analysis is far too much for a centralized staff to handle. Such information has been developed, however, by many States and localities. The local office of your State employment service is the best place to ask about local-area employment projections. Names and addresses of these State and local information sources and suggestions for additional information on the job market are given in the following section, Where to Go for More Information.

The **Earnings** section helps answer many of the questions that you may ask when choosing a career. Will the income be high enough to maintain the standard of living I want and justify my training costs? How much will my earnings increase as I gain experience? Do some areas of the country or some industries offer better pay than others for the same type of work?

Like most people, you probably think of earnings as money. But money is only one type of financial reward for work. Paid vacations, health insurance, uniforms, and discounts on clothing or other merchandise also are part of total earnings.

About 9 out of 10 workers receive money income in the form of a *wage or salary*. A wage usually is an hourly or daily rate of pay, while a salary is a weekly, monthly, or yearly rate. Most craft workers, operatives, and laborers are wage earners, while most professional, technical, and clerical workers are salary earners.

In addition to their regular pay, wage and salary workers may receive extra money for working overtime, or on a night shift or irregular schedule. In some occupations, workers also may receive tips or be paid a commission based on the amount of sales or services they provide to customers. Factory workers are sometimes paid a piece rate, which is an extra payment for each item they produce. For many workers, these types of pay amount to a large part of their total earnings.

The remaining 10 percent of all workers are in business for themselves and earn *self-employment income* instead of wages or salaries. This group includes workers in a wide variety of occupations:Physicians, shopkeepers, barbers, writers, photographers, and farmers are examples of workers who frequently are self-employed.

Workers in some occupations earn self-employment income in addition to their wages or salaries. For example, electricians and carpenters often do small repair or remodeling jobs during evenings or weekends, and college professors frequently are paid for publishing articles based on independent research.

Besides money income, most wage and salary workers receive a variety of *fringe benefits* as part of their earnings on the job. Several are required by Federal and State law, including social security, workers' compensation, and unemployment insurance. These benefits provide income to persons when they are not working because of old age, work-related injury or disability, or lack of suitable jobs.

Among the most common fringe benefits are paid vacations, holidays, and sick leave. In addition, many workers are covered by life, health, and accident insurance; participate in retirement plans; and are entitled to supplemental unemployment benefits. All of these benefits are provided—in part or in full—through their employers. Some employers also offer stock options and profit-sharing plans, savings plans, and bonuses.

Workers in many occupations receive part of their earnings in the form of goods and services, or *payments in kind*. Sales workers in department stores, for example, often receive discounts on merchandise. Workers in other jobs may receive free meals, housing, business expense accounts, or free transportation on company-owned planes.

Which jobs pay the most? This is a difficult question to answer because good information is available for only one type of earnings—wages and salaries—and for some occupations even this is unavailable. Nevertheless, the *Handbook* does include some comparisons of earnings among occupations. Most statements indicate whether earnings in an occupation are greater than or less than the average earnings of workers who are not supervisors and work in private industry, but not in farming. This group represented about 60 percent of all workers in 1976 and had the most reliable earnings data currently available for comparison purposes.

Besides differences among occupations, many levels of pay exist within each occupation. Beginning workers almost always earn less than those who have been on the job for some time because pay rates increase as workers gain experience or do more responsible work.

Earnings in an occupation also vary by geographic location. The average weekly earnings of beginning computer programmers, for example, vary considerably from city to city. (See table 1.) The highest earnings of the nine cities listed occurred in Detroit, Mich., and the lowest in Chattanooga, Tenn. Although it is generally true that earnings are higher in the North Central and Northeast regions than in the West and South, there are exceptions. You also should remember that those cities which offer the highest earnings are often those in which it is most expensive to live.

Table 1. Average weekly earnings of beginning computer programmers, 1976, by selected city

City	Average weekly earnings
Detroit	$239.50
New York	239.00
Cleveland	238.00
Chicago	230.00
San Francisco-Oakland	229.50
Greenville-Spartanburg, S.C.	201.50
Baltimore	193.00
Salt Lake City-Ogden	190.00
Chattanooga	185.50

SOURCE: Bureau of Labor Statistics.

In addition, workers in the same occupation may have different earnings depending on the industry in which they work. For example, senior accounting clerks in 1975 averaged $206.50 a week in public utilities, $181 a week in manufacturing, $169.50 a week in wholesale trade, and $164 a week in services, but only $150.50 in retail trade and $154 in finance, insurance, and real estate.

Salaries also vary by the type of work a person performs. The salaries of Ph. D. chemists, for example, vary considerably depending on the specific nature of the job, as shown in table 2. In 1976, chemists in management jobs earned $7,000 a year more than those in marketing and technical services. Chemists in research and development, however, earned $4,200 less than those in marketing, but $4,800 more than chemistry professors.

Because of these variations in earnings, you should check with a counselor or with local employers if you are interested in specific earnings information for occupations in your area.

The **Working Conditions** section provides information on factors that can affect job satisfaction because preferences for working conditions vary considerably among individuals. Some people, for example, prefer outdoor work while others prefer working in an office. Some people like the variety of shift work, and others want the steadiness of a 9-to-5 job. Following is a list of several working conditions that apply to some of the occupations in the *Handbook*.

Overtime work. When overtime is required on a job, employees must give up some of their free time and need to be flexible in their personal lives. Overtime, however, does provide the opportunity to increase earning power.

Shift work. Evening or night work is part of the regular work schedule in some jobs. Employees who work on these shifts usually are working while most other people are off. Some per-

Table 2. Average annual salaries of chemists, with Ph.D. degrees, by type of work, 1976

Type of work	Annual salaries
Management	$36,500
Marketing and technical services	29,500
Research and development	25,300
Teaching	20,500
Other	26,900

SOURCE: American Chemical Society.

sons prefer shift work, however, because they can pursue certain daytime activities, such as hunting, fishing, or gardening.

Environment. Work settings vary from clean, air-conditioned offices to places that are dirty, greasy, or poorly ventilated. By knowing the setting of jobs you find interesting, you can avoid an environment that you may find particularly unpleasant.

Outdoor work. Persons who work outdoors are exposed to all types of weather. This may be preferred to indoor work, however, by those who consider outdoor work more healthful.

Hazards. In some jobs employees are subject to possible burns, cuts, falls, and other injuries and must be careful to follow safety precautions.

Physical demands. Some jobs require standing, stooping, or heavy lifting. You should be sure that you have the physical strength and stamina required before seeking one of these jobs.

Considering working conditions when you make up your mind about a career can help you choose a job that brings you satisfaction and enjoyment.

WHERE TO GO FOR MORE INFORMATION

Whether you have questions about a particular job or are trying to compare various fields, the *Occupational Outlook Handbook* is a good place to begin. The *Handbook* will introduce you to some of the important aspects of an occupation and answer many of your initial questions. But the *Handbook* is only one of many sources of information about jobs and careers. After reading a few *Handbook* statements, you may decide that you want more detailed information about a particular occupation. Or you may want to find out where you can find this kind of work in your community or where you can go for appropriate training. If you are willing to make an effort, you will discover a wealth of occupational information—much of it available at little or no cost.

Sources of Career Information

Much information on careers is put out by government, industry, trade unions, schools, professional associations, private guidance services, and other organizations. You should be careful in assessing any single piece of career guidance material. Keep in mind the date and source, in particular. Material that is too old may contain obsolete or even misleading information. Be especially cautious about accepting information on employment outlook, earnings, and training requirements if it is more than 5 years old. You also need to consider the source—and thus the intent—of the career guidance material you obtain.

Although some occupational materials are produced solely for the purpose of objective vocational guidance, others are produced for recruitment purposes. You should be wary of biased information, which may tend to leave out important items, overglamorize the occupation, overstate the earnings, or exaggerate the demand for workers.

School counselors can be a very important source of guidance information. Counselors should be able to refer you to the different types of career materials available in your school or community. They are likely to be familiar with the job market. They also can discuss entry requirements and costs of the schools, colleges, or training programs that offer preparation for the kind of work in which you are interested. Most important of all, your counselor can help you consider the occupational information you obtain in relation to your own abilities, personal aspirations, and career goals.

Guidance offices usually have collections of career information. In fact, the copy of the *Handbook* that you're reading now may have come from the guidance office. Find out what else the office has to offer.

Some schools have **career centers**; often, these are located in or near the library or media center. Career centers provide a sampling of printed and audiovisual career information materials, and also may offer individual counseling, group discussions, guest speakers, and field trips.

Libraries have books, brochures, magazines, and audiovisual materials that contain information about jobs and careers. Check your school library or media center, of course—but don't forget the public library. Many libraries have pamphlet files devoted to specific occupations. Some libraries also have collections of filmstrips, records and tapes, and microfilms with occupational information. The reference shelf undoubtedly contains one directory or more that you will find useful if you want to get the names of specific schools, colleges, or business concerns. The library staff can direct you to the information best suited to your needs.

Trade unions, business firms, trade associations, professional societies, and educational institutions all publish career information, and much of this is available for the asking.

The Sources of Additional Information section at the end of most *Handbook* statements lists organizations you can write to. This is a good way to begin. For the names and addresses of other organizations, consult the directories on your library's reference shelf. There, you are likely to find directories that list:

—trade associations.

—professional associations.

—business firms.

—junior and community colleges.

—colleges and universities.

—home study and correspondence programs.

—business, trade, and technical schools.

—sources of scholarships and financial aid.

Your school library or career center may have one directory or more put out by commercial publishers that list sources of career information by occupation.

Another useful directory is the U.S. Office of Education's *Directory of Postsecondary Schools with Occupational Programs, 1973-74*, which lists schools offering specific occupational training programs. The directory lists private business, trade, and technical schools as well as community and junior colleges and 4-year colleges and universities.

Computer-assisted occupational information systems have been installed in some schools and career centers. These systems allow users to obtain career information stored in a computer by entering specific requests and receiving immediate answers. Through the occupational information systems, users are able to examine the ways in which different personal abilities, interests, and preferences are related to different occu-

pations. The U.S. Department of Labor is currently providing funds for such systems in eight States.

Don't overlook the importance of **personal contacts**. An interview with someone in a particular job can often tell you much more than a booklet or brochure can. By asking the right questions, you find out what kind of training is really important, how workers got their first jobs as well as the one they're in now, and what they like and dislike about the work.

State employment security agencies in many States publish career briefs for dozens of different occupations and industries. These briefs usually describe earnings and job outlook information for a particular State—and sometimes for a city or metropolitan area. By contrast, the *Handbook* gives information for the Nation as a whole. In addition, a number of States publish brochures on writing resumes, finding job openings, preparing for interviews, and other aspects of a job search. To find out what materials are available for your State, consult the U.S. Employment and Training Administration's 1976 *Guide to Local Occupational Information*. Or write directly to the chief information officer in your State employment security agency. Following is a list of their titles and addresses:

Alabama

Public Information Officer, Department of Industrial Relations, Industrial Relations Bldg., 649 Monroe St., Montgomery, Ala. 36130.

Alaska

Information Officer, Employment Security Division, Department of Labor, P.O. Box 3-7000, Juneau, Alaska 99811.

Arizona

Chief of Information and Education, Arizona State Employment Security Commission, P.O. Box 6123, Phoenix, Ariz. 85005.

Arkansas

Public Information Officer, Employment Security Division, P.O. Box 2981, Little Rock, Ark. 72203.

California

Public Information Section, Employment Development Department, 800 Capitol Mall, Sacramento, Calif. 95814.

Colorado

Public Information Officer, Division of Employment, Department of Labor and Employment, 251 East 12th Ave., Denver, Colo. 80203.

Connecticut

Public Information Supervisor, Connecticut Employment Security Division, 200 Folly Brook Blvd., Weatherfield, Conn. 06109.

Delaware

Secretary, Department of Labor, 801 West 14th St., Wilmington, Del. 19899.

District of Columbia

Chief, Community Relations and Information Office, D.C. Department of Manpower, Room 601, 500 C St. NW., Washington, D.C. 20212.

Florida

Information Director, Florida Department of Commerce, Collins Bldg., Tallahassee, Fla. 32304.

Georgia

Chief of Public Relations and Information, Georgia Department of Labor, 254 Washington St. SW., Atlanta, Ga. 30334.

Hawaii

Information Specialist, Department of Labor and Industrial Relations, 825 Mililani St., Honolulu, Hawaii 96813.

Idaho

Public Information Coordinator, Department of Employment, P.O. Box 35, Boise, Idaho 83707.

Illinois

Director, Communications and Public Information, Illinois Department of Labor, State Office Bldg., Room 705, Springfield, Ill. 62706.

Indiana

Director of Information and Education, Employment Security Division, 10 North Senate Ave., Indianapolis, Ind. 46204.

Iowa

Chief of Information Services, Employment Security Commission, 1000 East Grand Ave., Des Moines, Iowa 50319.

Kansas

Public Relations Director, Department of Human Resources, 401 Topeka Ave., Topeka, Kans. 66603.

Kentucky

Supervisor, Public Information, Department of Human Resources, 592 East Main St., Frankfort, Ky. 40601.

Louisiana

Public Relations Director, Department of Employment Security, P.O. Box 44094, Baton Rouge, La. 70804.

Maine

Chairman, Employment Security Commission, 20 Union St., Augusta, Maine 04330.

Maryland

Director of Public Relations, Department of Employment and Social Services, Room 601, 1100 North Eutaw St., Baltimore, Md. 21201.

Massachusetts

Supervisor of Information, Division of Employment Security, Hurley Bldg., Government Center, Boston, Mass. 02114.

Michigan

Director, Information Services Division, Employment Security Commission, Department of Labor Bldg., 7310 Woodward Ave., Detroit, Mich. 48202.

Minnesota

Director of Public Information, Department of Employment Services, 390 North Robert St., St. Paul, Minn. 55101.

Mississippi

Public Relations Representative, Employment Security Commission, P.O. Box 1699, Jackson, Miss. 39205.

Missouri

Information Supervisor, Division of Employment Security, Department of Labor and Industrial Relations, P.O. Box 59, Jefferson City, Mo. 65101.

Montana

Information Officer, Employment Security Division, P.O. Box 1728, Helena, Mont. 59601.

Nebraska

Information Officer, Division of Employment, Department of Labor, P.O. Box 94600, State House Station, Lincoln, Nebr. 68509.

Nevada

Public Information Officer, Employment Security Department, 500 East Third St., Carson City, Nev. 89701.

New Hampshire

Commissioner, Department of Employment Security, 32 South Maine St., Concord, N.H. 03301.

New Jersey

Director of Public Information, Division of Employment Security, Department of Labor and Industry, John Fitch Plaza, Trenton, N.J. 08625.

New Mexico

Information Officer, Employment Security Commission, P.O. Box 1928, Albuquerque, N. Mex. 87103.

New York

Director, Division of Research and Statistics, Department of Labor, 2 World Trade Center, New York, N.Y. 10047.

North Carolina

Communications and Information Specialist, Employment Security Commission, P.O. Box 25903, Raleigh, N.C. 27602.

North Dakota

Public Information Section, Employment Security Bureau, 145 South Front St., Bismarck, N. Dak. 58501.

Ohio

Public Information Officer, Bureau of Employment Services, 145 South Front St., Columbus, Ohio 43216.

Oklahoma

Information Director, Employment Security Commission, Will Rogers Memorial Office Bldg., Oklahoma City, Okla. 73105.

Oregon

Information Officer, Employment Division, 875 Union St. NE., Salem, Oreg. 97310.

Pennsylvania

Director of Public Relations, Bureau of Employment Security, Department of Labor and Industry Bldg., 7th and Forster Sts., Harrisburg, Pa. 17121.

Puerto Rico

Information Officer, Bureau of Employment Security, 414 Barbosa Ave., Hato Rey, P.R. 00917.

Rhode Island

Information Officer, Department of Employment Security, 24 Mason St., Providence, R.I. 02903.

South Carolina

Public Information Director, Employment Security Commission, P.O. Box 995, Columbia, S.C. 29202.

South Dakota

Public Information Director, Department of Labor, Office Bldg. No. 2, Pierre, S. Dak. 57501.

Tennessee

Chief of Public Relations, Department of Employment Security, 519 Cordell Hull Bldg., Nashville, Tenn. 37219.

Texas

Public Information Officer, Texas Employment Commission, TEC Bldg., 15th and Congress Ave., Austin, Tex. 78778.

Utah

Public Relations Director, Department of Employment Security, P.O. Box 11249, Salt Lake City, Utah 84111.

Vermont

Public Information Officer, Department of Employment Security, P.O. Box 488, Montpelier, Vt. 05602.

Virginia

Director, Information Services, Virginia Employment Commission, P.O. Box 1358, Richmond, Va. 23211.

Washington

Information Officer, Employment Security Department, P.O. Box 367, Olympia, Wash. 98504.

West Virginia

Information Representative, Department of Employment Security, 4407 McCorkle Ave. SE., Charleston, W. Va. 25305.

Wisconsin

Director of Information, Department of Industry, Labor, and Human Relations, P.O. Box 2209, Madison, Wis. 53701.

Wyoming

Information Officer, Employment Security Commission, P.O. Box 2760, Casper, Wyo. 82601.

Career Information for Special Groups

Certain groups of jobseekers face special difficulties in obtaining suitable and satisfying employment. All too often, veterans, youth, handicapped persons, members of ethnic and racial minorities, older workers, and women experience difficulty in the labor market. Choosing a career wisely and realistically is important for everyone, but it is doubly important for members of these groups. Special counseling, training, and placement are available in many communities—through the public employment service, community service agencies, or other organizations.

In addition, literature on career guidance and vocational training for special labor force groups is available from the Federal Government. Most of these publications can be obtained free of charge. Following are selected examples:

Youth

Employment and Training for Youth. (program fact sheet), February 1977.

Office of Information, Inquiries Section, Room 10225, Employment and Training Administration, U.S. Department of Labor, 601 D St. NW., Washington, D.C. 20213.

A Message to Young Workers About the Fair Labor Standards Act, As Amended in 1974. (WH Publication 1236), 1976.

Office of Information, Room 4331, Employment Standards Administration, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, D.C. 20210.

Mentally handicapped

These, Too, Must Be Equal:America's Needs in Habilitation and Employment of the Mentally Retarded, 1974.

President's Committee on Mental Retardation, Regional Office Building, 7th and D Sts. SW., Washington, D.C. 20201.

Guide to Job Placement of Mentally Retarded Workers.
Preparing for Work, 1975.
How to Get a Job.
Jobs and Mentally Retarded People, 1974.

President's Committee on Employment of the Handicapped, Room 600, Vanguard Building, 1111 20th St. NW., Washington, D.C. 20036.

Affirmative Action to Employ Handicapped People.

Office of Information, Room 4331, Employment Standards Administration, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, D.C. 20210.

Physically handicapped

Careers for the Homebound.
People at Work:50 Profiles of Men and Women With MS, 1975.

President's Committee on Employment of the Handicapped, Room 600, Vanguard Building, 1111 20th St. NW., Washington, D.C. 20036.

Affirmative Action to Employ Handicapped People.

Office of Information, Room 4331, Employment Standards Administration, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, D.C. 20210.

Older workers

The Law Against Age Discrimination in Employment. (WH Publication 1303).

Office of Information, Room 4331, Employment Standards Administration, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, D.C. 20210.

Services for Older Workers. (program fact sheet), April 1977.

Memo to Mature Jobseekers, 1977.

Office of Information, Inquiries Section, Room 10225, Employment and Training Administration, U.S. Department of Labor, 601 D St. NW., Washington, D.C. 20213.

Employment and Volunteer Opportunities for Older People. (AoA Fact Sheet), Revised 1976.

National Clearinghouse on Aging, Room 4146, U.S. Department of Health, Education, and Welfare, 330 Independence Ave. SW., Washington, D.C. 20201.

Women

Steps to Opening the Skilled Trades to Women, June 1974.

Why Not be an Apprentice and Become a Skilled Craft Worker. (leaflet 52), 1974.

Publications of the Women's Bureau, January 1977.

Selected Sources of Career Information, 1974.

Women's Bureau, Employment Standards Administration, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, D.C. 20210.

Veterans

Out of the Service and Looking for a Job? Here's Help!, 1976.

Veterans for Hire: Good Business, 1976.

Office of Information, Inquiries Section, Room 10225, Employment and Training Administration, U.S. Department of Labor, 601 D St. NW., Washington, D.C. 20213.

Veterans Readjustment Appointments—Questions and Answers. (SRE-36), revised 1977.

Bureau of Recruiting and Examining, Room 6552, Civil Service Commission, 1900 E St. NW., Washington, D.C. 20415.

The following publications are available from VA regional offices (listed in the telephone directory under "United States Government—Veterans Administration") or from:

Department of Veterans Benefits - 232A, Veterans Administration Central Office, 810 Vermont Ave. NW., Washington, D.C. 20420.

Apprenticeship or Other On-Job Training Benefits for Veterans With Service Since January 31, 1975. (VA pamphlet 20-69-4), March 1975.

A Summary of Employment Benefits and Opportunities for Vietnam Era Veterans. (VA pamphlet 20-69-6), December 1974.

Information on Finding a Job

Do you need help in finding a job? For information on job openings, follow up as many leads as possible. Parents, neighbors, teachers, and counselors may know of jobs. Check the want ads. Investigate the local office of your State employment service. And find out whether private or nonprofit employment agencies in your community can help you. The following section will give you some idea of where you can go to look for a job and what sort of help to expect.

Informal job search methods. Informal methods of job search are the most popular, and also the most effective. Informal methods include direct application to employers with or without referral by friends or relatives. Jobseekers locate a firm that might employ them and file an application, often without certain knowledge that an opening exists.

You can find targets for your informal search in several ways. The Yellow Pages and local chambers of commerce will give you the names and addresses of appropriate firms in the community where you wish to work. You can also get listings of most firms in a specific industry—banking, insurance, manufacturing, and newspaper publishing, for example—by consulting one of the directories on the reference shelf of your public library. Friends and relatives may suggest places to apply for a job, and people you meet in the course of your job search are also likely to give you ideas.

Want ads. The "Help Wanted" ads in a major newspaper contain hundreds of job listings. As a job search tool, they have two advantages: They are cheap and easy to acquire, and they often result in successful placement. There are disadvantages as well. Want ads give a distorted view of the local labor market, for they tend to underrepresent small firms. They also tend to overrepresent certain occupations, such as clerical and sales jobs. How helpful they are to you will depend largely on the kind of job you seek.

Bear in mind that want ads do not provide complete information; many ads give little or no description of the job, working conditions, and pay. Some ads omit the identity of the employer. In addition, firms often run multiple listings. Some ads offer jobs in other cities (which do not help the local worker); others advertise employment agencies rather than employment.

If you use the want ads, keep the following suggestions in mind:

* Don't rely *exclusively* on the want ads; follow up other leads, too.
* Answer ads promptly. The opening may be filled before the ad stops running.
* Follow the ads diligently. Checking them every day as early as possible gives you the best advantage over other applicants, which may mean the difference between a job and a rejection.
* Don't expect too much from "blind ads" that do not reveal the employer's identity. Employers use blind ads to avoid being swamped with applicants, or to fill a particular vacancy quietly and confidentially. The chances of finding a job through blind ads tend to be slim.
* Be cautious about answering "no experience necessary" ads. Most employers are able to fill job openings that do not require experience without advertising in the newspaper. This type of ad may mean that the job is hard to fill because of low wages or poor working conditions, or because it is straight commission work.

Public employment service. The public employment service, also called

the Job Service, can be a good source of information about job openings in your community. Employment security (ES) agencies in each of the 50 States and the District of Columbia are affiliated with the U.S. Employment Service, and provide their services without charge. Operating through a network of 2,500 local offices, State agencies help jobseekers find employment and help employers find qualified workers. To find the office nearest you, look in the State government telephone listings under "Job Service" or "Employment." If the local office does not provide the information or services you are looking for, write to the information officer in your State capital. Addresses are given in the first section of this chapter.

General services. Assuming you come to your local employment service office because you're looking for a job, the first step is to fill out an application that asks for general background and work history. To speed up the process, you should bring along complete information on previous jobs, including dates of employment, names and addresses of employers, and pay levels.

After completing the application, you will talk briefly with an interviewer in order to be classified into a particular job cluster—professional and management, sales, clerical, and so forth. This process, although crucial, takes very little time. If you have specific training and experience and know exactly what you want, the initial interview may suffice. Most applicants, however, can benefit from additional guidance services, which are available on request. The unskilled and inexperienced may take a general aptitude test battery that measures their abilities, and a vocational interest questionaire that measures their occupational interests. Specific tests in typing and shorthand may also be given.

You may also talk at length with occupational counselors. These counselors, or interviewers, can assist in a wide range of areas. They can help you pinpoint a suitable field of interest, suggest training programs and other means of preparing for a particular occupation, or simply advise you on compiling a resume.

One other aspect of your local office's services deserves particular attention—the occupational registers. Employment service offices often maintain files of resumes of qualified workers in professional, clerical, and craft occupations, for use by employers seeking such workers. Ask to have your resume filed in the appropriate register.

Job Information Service. The Job Information Service (JIS) plays an important role in matching workers and jobs. JIS provides a self-service listing of job openings, as well as a library of occupational and job search literature. Employment service offices in most large cities have a Job Bank as well--a computerized file of job openings, revised and printed out daily. Because it is self-service, the JIS unit is meant for applicants who know what kind of work they are qualified to do. Those applicants can look over Job Bank listings and select the openings they want to apply for. This gives them quick access to job information and frees employment service staff to spend more time with clients who need personal assistance.

The JIS may include the Job Bank Openings Summary (JBOS) and the Job Bank Frequently Listed Openings Report (JOB-FLO). JBOS is a monthly report that provides information on job opportunities listed during the previous month in Job Banks across the Nation. JOB-FLO provides similar information, but focuses on the "high volume" occupations—those with the greatest number of openings. JBOS and JOB-FLO may not help you find a particular opening, but they can describe employment trends in a particular city or pinpoint the cities that have the greatest numbers of openings in a particular occupation.

The JIS also includes a monthly publication, entitled "Occupations in Demand," that reports the number and locations of openings in high-demand occupations during the previous month. It is designed to be easily read by the average jobseeker and can be found in libraries and counseling offices as well as at the employment service.

Special services. Serving people with job market disadvantages is an important function of the employment service, and many local offices have specially trained counselors who advise veterans, youth, handicapped, or older workers.

By law, veterans are entitled to priority in interviewing, counseling, testing, job development, and job placement. Special counselors called veterans reemployment representatives are trained to deal with the particular problems of veterans, many of whom find it difficult to readjust to civilian life. While such veterans often face multiple problems, joblessness alone is a major barrier to resuming an ordinary life. Special help for disabled veterans begins with outreach units in each State, whose job it is to identify jobless disabled veterans and make them aware of the many kinds of assistance available to them.

As part of the effort to reduce excessive youth unemployment, local employment service offices test and counsel young people, and refer them to training programs or jobs whenever possible. These offices also manage summer youth programs. Youthful jobseekers from very poor families receive information on the various kinds of federally funded job programs for young people, including part-time and work-experience projects and the Job Corps.

For people with mental or physical disabilities, the employment service provides assistance in making realistic job choices, and in overcoming problems related to getting and holding jobs. Job openings for handicapped workers are listed as well. Often, these openings are with government contractors and other firms that are making a positive effort to employ handicapped workers.

Older worker specialists in many local employment service offices assist middle-aged and older workers, whose job search generally differs from that of younger workers. Both counseling and placement services are tailored to the unique needs of older workers. Jobseekers over 55 who have very low incomes may be referred to one of the thousands of part-time, community service jobs

for the elderly funded by the Federal Government.

Private employment agencies. In the appropriate section of the classified ads or the telephone book you can find numerous advertisements for private employment agencies. All are in business to make money, but some offer higher quality service and better chances of successful placement than others.

The three main places in which private agencies advertise are newspaper want ads, the Yellow Pages, and trade journals. Telephone listings give little more than the name, address, phone number, and specialty of the agency, while trade journals only list openings for a particular occupation, such as accountant or computer programmmer. Want ads, then, are the best source of general listings of agencies.

These listings fall into two categories—those offering specific openings and those offering general promise of employment. You should concentrate on the former, using the latter only as a last resort. With a specific opening mentioned in the ad, you have greater assurance of the agency's desire to place qualified individuals in suitable jobs.

When responding to such an ad, you may learn more about the job over the phone. If you are interested, visit the agency, fill out an application, present a resume, and talk with an interviewer. The agency will then arrange an interview with the employer if you are qualified, and perhaps suggest alternative openings if you are not.

Most agencies operate on a commission basis, with the fee contingent upon a successful match. Agencies advertising "no fees, no contracts" are paid by the employer and charge the applicant nothing. Many other agencies, however, do charge their applicants. You should find out before using them exactly what the services will cost you.

Community agencies. A growing number of nonprofit organizations throughout the Nation provide counseling, career development, and job placement services. These agencies generally concentrate on services for a particular labor force group—women, the elderly, youth, minorities, or ex-offenders, for example.

Community employment agencies serve an important function in providing the extensive counseling that many disadvantaged jobseekers require. They often help their clients resolve personal, family, or other fundamental problems that may stand in the way of finding a suitable job. Some agencies provide necessary job training, while others refer their clients to training programs elsewhere. For the most part, these community agencies take a strong active interest in their clients, and provide an array of services designed to help people find and keep jobs.

It's up to you to discover whether there are such agencies in your community—and whether they can help you. The State employment service should be able to tell you whether such an agency has been established in your community. If the local office cannot help, write the State information officer. Your church, synagogue, or local library may have the information, too. The U.S. Department of Labor is another possible source of information, for many of these agencies receive some or all of their funding from the Federal Government, through the Comprehensive Employment and Training Act (CETA). Among its many and varied provisions, CETA authorizes Federal money for local organizations that offer job counseling, training, and placement help to unemployed and disadvantaged persons. For further information, write:

Office of Comprehensive Employment Development, Employment and Training Administration, U.S. Department of Labor, Room 6000, 601 D St. NW., Washington, D.C., 20213; or the Office of Information, Room 10406, at the same address.

Another likely source of information is the U.S. Department of Labor's *Directory for Reaching Minority Groups*. Although the 1973 directory is out of print, a revised edition is being prepared, and will list organizations that provide job information, training, and other services to minorities. For information, write to:

Bureau of Apprenticeship and Training, U.S. Department of Labor, 601 D St. NW., Washington, D.C. 20213.

A directory that lists employment counseling and advocacy organizations for women is available for a nominal charge from:

Wider Opportunities for Women (WOW), 1649 K St. NW., Washington, D.C., 20006.

College career planning and placement offices. For those who have access to them, career planning and placement offices at colleges and universities offer the jobseeker many valuable services. Like the community agencies that serve disadvantaged jobseekers by offering supportive services, college placement offices function as more than just employment agencies. In addition to counseling, they teach students to acquire jobseeking skills. They emphasize writing resumes and letters of application, making a list of possible employers, preparing for interviews, and other aspects of job searching. College placement offices offer other services, too. At larger campuses they bring students and employers together by providing schedules and facilities for interviews with industry recruiters. Many offices also maintain lists of local part-time and temporary jobs, and some have files of summer openings.

Labor Market Information

All State employment security agencies develop detailed labor market data needed by employment and training specialists and educators who plan for local needs. Such information helps policymakers decide whether or not to expand a vocational training program, for example—or drop it altogether. Jobseekers and counselors also may find these studies helpful. Typically, State agencies publish reports that deal with future occupational supply, characteristics of the work force, changes in State and area economic activities, and the employment structure of important industries. For all States, and for nearly all Standard Metropolitan Statistical Areas (SMSA's) of 50,000 inhabitants or more, data are available that show current employment as

well as estimated future needs. This information is very detailed; generally, each State issues a report covering current and future employment for as many as 200 industries and 400 occupations. In addition, major statistical indicators of labor market activity are released by all of the States on a monthly, quarterly, and annual basis. For information on the various labor market studies, reports, and analyses available in a specific State, contact the chief of research and analysis in the State employment security agency. Titles and addresses are as follows:

Alabama

Chief, Research and Statistics, Department of Industrial Relations, Industrial Relations Bldg., 649 Monroe St., Montgomery, Ala. 36130.

Alaska

Chief, Research and Analysis, Employment Security Division, Department of Labor, P.O. Box 3-7000, Juneau, Alaska 99811.

Arizona

Manager, Labor Market Information, Research and Analysis, Department of Economic Security, P.O. Box 6123, Phoenix, Ariz. 85005.

Arkansas

Chief, Research and Statistics, Employment Security Division, P.O. Box 2981, Little Rock, Ark. 72203.

California

Chief, Employment Data and Research Division, Employment Development Department, 800 Capitol Mall, Sacramento, Calif. 95814.

Colorado

Chief, Research and Analysis, Division of Employment, Department of Labor and Employment, 251 East 12th Ave., Denver, Colo. 80203.

Connecticut

Director, Research and Information, Connecticut Employment Security Division, 200 Folly Brook Blvd., Weatherfield, Conn. 06109.

Delaware

Chief, Office of Research, Planning, and Evaluation, Department of Labor, 801 West 14th St., Wilmington, Del. 19899.

District of Columbia

Chief, Division of Manpower Reports and Analysis, Office of Administration and Management Services, D.C. Department 6f Manpower, 605 G St. NW., Washington, D.C. 20001.

Florida

Director, Research and Statistics, Division of Employment Security, Florida Department of Commerce, 1720 South Gadsden St., Tallahassee, Fla. 32304.

Georgia

Director, Information Systems, Employment Security Agency, Department of Labor, 254 Washington St. SW., Atlanta, Ga. 30334.

Hawaii

Chief, Research and Statistics, Department of Labor and Industrial Relations, 825 Mililani St., Honolulu, Hawaii 96813.

Idaho

Chief, Research and Analysis, Department of Employment, P.O. Box 35, Boise, Idaho 83707.

Illinois

Manager, Research and Analysis Division, Bureau of Employment Security, Department of Labor, 910 South Michigan Ave., Chicago, Ill. 60605.

Indiana

Chief of Research, Employment Security Division, 10 North Senate Ave., Indianapolis, Ind. 46204.

Iowa

Chief, Research and Statistics, Employment Security Commission, 1000 East Grand Ave., Des Monies, Iowa 50319.

Kansas

Chief, Research and Analysis Department, Employment Security Division, Department of Labor, 401 Topeka Ave., Topeka, Kans. 66603.

Kentucky

Director, Research and Special Projects, Department of Human Resources, State Office Building Annex, Frankfort, Ky. 40601.

Louisiana

Acting Chief, Research and Statistics, Department of Employment Security, P.O. Box 44094, Baton Rouge, La. 70804.

Maine

Director, Manpower Research Division, Employment Security Commission, 20 Union St., Augusta, Maine 04330.

Maryland

Acting Director, Research and Analysis, Department of Human Resources, 1100 North Eutaw St., Baltimore, Md. 21201.

Massachusetts

Assistant Director, Research and Information Service, Division of Employment Security, Hurley Bldg., Government Center, Boston, Mass. 02114.

Michigan

Director, Research and Statistics Division, Employment Security Commission, Department of Labor Bldg., 7310 Woodward Ave., Detroit, Mich. 48202.

Minnesota

Director, Research and Planning, Department of Employment Services, 390 North Robert St., St. Paul, Minn. 55101.

Mississippi

Chief, Research and Statistics, Employment Security Commission, P.O. Box 1699, Jackson, Miss. 39205.

Missouri

Chief, Research and Analysis, Division of Employment Security, Department of Labor and Industrial Relations, P.O. Box 59, Jefferson City, Mo. 65101.

Montana

Chief, Research and Analysis, Employment Security Division, P.O. Box 1728, Helena, Mont. 59601.

Nebraska

Chief, Research and Statistics, Division of Employment, Department of Labor, P.O. Box 94600, State House Station, Lincoln, Nebr. 68509.

Nevada

Chief, Manpower Information and Research, Employment Security Department, 500 East Third St., Carson City, Nev. 89701.

New Hampshire

Supervisor, Economic Analysis and Reports, Department of Employment Security, 32 South Main St., Concord, N.H. 03301.

New Jersey

Director, Division of Planning and Research, Department of Labor and Industry, John Fitch Plaza, Trenton, N.J. 08625.

New Mexico

Chief, Research and Statistics, Employment Security Commission, P.O. Box 1928, Albuquerque, N. Mex. 87103.

New York

Director, Division of Research and Statistics, Department of Labor, 2 World Trade Center, New York, N.Y. 10047.

North Carolina

Manager, Bureau of Employment Security Research, Employment Security Commission, P.O. Box 25903, Raleigh, N.C. 27602.

North Dakota

Chief, Reports and Analysis, Employment Security Bureau, P.O. Box 1537, Bismarck, N. Dak. 58501.

Ohio

Director, Division of Research and Statistics, Bureau of Employment Services, 145 South Front St., Columbus, Ohio 43216.

Oklahoma

Chief, Research and Planning Division, Employment Security Commission, Will Rogers Memorial Office Bldg., Oklahoma City, Okla. 73105.

Oregon

Chief, Research and Statistics, Employment Division, 875 Union St. NE., Salem, Oreg. 97310.

Pennsylvania

Assistant Director, Research and Statistics, Bureau of Employment Security, Department of Labor and Industry, 7th and Forster Sts., Harrisburg, Pa. 17121.

Puerto Rico

Chief of Research and Statistics, Bureau of Employment Security, 427 Barbosa Ave., Hato Rey, P.R. 00917.

Rhode Island

Supervisor, Employment Security Research, Department of Employment Security, 24 Mason St., Providence, R.I. 02903.

South Carolina

Director, Manpower Research and Analysis, Employment Security Commission, 1550 Gadsden St., Columbia, S.C. 29202.

South Dakota

Chief, Research and Statistics, Employment Security Department, 607 North Fourth St., Box 730, Aberdeen, S. Dak. 57401.

Tennessee

Chief, Research and Statistics, Department of Employment Security, 519 Cordell Hull Bldg., Nashville, Tenn. 37219.

Texas

Chief, Manpower Data Analysis and Research, Texas Employment Commission, TEC Bldg., 15th and Congress Ave., Austin, Tex. 78778.

Utah

Director, Reports and Analysis, Department of Employment Security, P.O. Box 11249, Salt Lake City, Utah 84111.

Vermont

Chief, Research and Statistics, Department of Employment Security, P.O. Box 488, Montpelier, Vt. 05602.

Virginia

Chief, Manpower Research, Virginia Employment Commission, P.O. Box 1358, Richmond, Va. 23211.

Washington

Chief, Research and Statistics, Employment Security Department, P.O. Box 367, Olympia, Wash. 98504.

West Virginia

Chief, Research and Statistics, Department of Employment Security, 112 California Ave., Charleston, W. Va. 25305.

Wisconsin

Director, Research and Statistics, Department of Industry, Labor and Human Relations, P.O. Box 2209, Madison, Wis. 53701.

Wyoming

Chief, Research and Analysis, Employment Security Commission, P.O. Box 2760, Casper, Wyo. 82601.

ASSUMPTIONS AND METHODS USED IN PREPARING EMPLOYMENT PROJECTIONS

Although the discussions of future job prospects contained in the *Handbook* are written in qualitative terms, the analyses upon which they are based begin with quantitative estimates of projected employment, replacement openings, and—in a few cases—supply.

These projections were developed using the most recent data available on population, industry and occupational employment, productivity, consumer expenditures, and other factors expected to affect employment. The Bureau's research offices provided much of these data, but many other agencies of the Federal Government were important contributors, including the Bureau of Apprenticeship and Training and the U.S. Employment Service, both in the Employment and Training Administration of the Department of Labor; the Bureau of the Census of the Department of Commerce; the Office of Education and the Rehabilitation Services Administration of the Department of Health, Education, and Welfare; the Veterans Administration; the Civil Service Commission; the Interstate Commerce Commission; the Civil Aeronautics Board; the Federal Communications Commission; the Department of Transportation; and the National Science Foundation.

In addition, experts in industry, unions, professional societies, and trade associations furnished data and supplied information through interviews. Many of these individuals also reviewed preliminary drafts of the statements. The information presented in each statement thus reflects the knowledge and judgment not only of the Bureau of Labor Statistics staff, but also of leaders in the fields discussed, although the Bureau, of course, takes full responsibility.

After the information from these sources was compiled, it was analyzed in conjunction with the Bureau's model of the economy in 1985. Like other models used in economic forecasting, it encompasses the major facets of the economy and represents a comprehensive view of its projected structure. The Bureau's model is comprised of internally consistent projections of gross national product (GNP) and its components—consumer expenditures, business investment, government expenditures, and net exports; industrial output and productivity; labor force; average weekly hours of work; and employment for detailed industry groups and occupations. The methods used to develop the employment projections in this edition of the *Handbook* are the same as those used in other Bureau of Labor Statistics studies of the economy. Detailed descriptions of these methods appear in *The U.S. Economy in 1985*, BLS Bulletin 1809, and the *BLS Handbook of Methods for Surveys and Studies*, Bulletin 1910.

Assumptions. The Bureau's projections to 1985 are based on the following general assumptions:

—The institutional framework of the U.S. economy will not change radically.

—Current social, technological, and scientific trends will continue, including values placed on work, education, income, and leisure.

—The economy will gradually recover from the high unemployment levels of the mid-1970's and reach full employment (defined as an unemployment rate of 4 percent) in the mid-1980's.

—No major event such as widespread or long-lasting energy shortages or war will significantly alter the industrial structure of the economy or alter the rate of economic growth.

—Trends in the occupational structure of industries will not be altered radically by changes in relative wages, technological changes, or other factors.

Methods. Beginning with population projections by age and sex developed by the Bureau of the Census, a projection of the total labor force is derived using expected labor force participation rates for each of these groups. In developing the participation rates, the Bureau takes into account a variety of factors that affect a person's decision to enter the labor force, such as school attendance, retirement practices, and family responsibilities.

The labor force projection then is translated into the level of GNP that would be produced by a fully employed labor force. Unemployed persons are subtracted from the labor force estimate and the result is multiplied by a projection of output per worker. The estimates of future output per worker are based on an analysis of trends in productivity (output per work hour) among industries and changes in the average weekly hours of work.

Next, the projection of GNP is divided among its major components: Consumer expenditures, business investment, government expenditures—Federal, State, and local—and net exports. Each of these components is broken down by producing industry. Thus, consumer expenditures, for example, are divided among industries producing goods and services such as housing, food, automobiles, medical care, and education.

Once estimates are developed for these products and services, they are translated into detailed projections of industry output, not only for the industries producing the final product, but also for the intermediate and basic industries that provide the raw materials, electric power, transportation, component parts, and other inputs required in the production process. To facilitate this translation, the

Department of Commerce has developed input-output tables that indicate the amount of output from each industry—steel, glass, plastics, etc.—that is required to produce a final product, automobiles for example.

By using estimates of future output per work-hour based on studies of productivity and technological trends for each industry, industry employment projections are derived from the output estimates.

These projections are then compared with employment projections derived using regression analysis. This analysis develops equations that relate employment by industry to combinations of economic variables, such as population and income, that are considered determinants of long-run changes in employment. By comparing projections resulting from input-output analysis and regression analysis, areas may be identified where one method produces a projection inconsistent with past trends or with the Bureau's economic model. The projections are then adjusted accordingly.

Occupational employment projections. Projections of industry employment are translated into occupational employment projections using an industry-occupation matrix. This matrix, which is divided into 200 industry sectors and 400 occupation sectors, describes the current and projected occupational structure of each industry. By applying the projected occupational structure for each industry to the industry employment projection and aggregating the resulting estimates, employment projections for each of the 400 occupations contained in the matrix are obtained. The growth rate of an occupation, thus, is determined by 1) changes in the proportion of workers in the occupation to the total work force in each industry, and 2) the growth rate of industries in which an occupation is concentrated. An occupation that is projected to increase as a proportion of the work force in each industry, for example, or one that is concentrated in industries projected to grow more rapidly than the average for all industries, would be projected to grow faster than the average for all occupations.

In some cases employment is related directly to one of the components of the Bureau's model--for example, the number of cosmetologists is related to consumer expenditures for beauty shop services. In others, employment is related to an independent variable not explicitly projected in the model, but believed to be a primary determinant of employment in that occupation. The projection of automobile mechanics, for example, is based on the expected stock of motor vehicles. Projections that are developed independently are compared with those in the matrix and revised, if necessary, to assure consistency.

Replacement needs. In addition to a projection of employment for each occupation, a projection is made of the number of workers who will be needed as replacements. Separations constitute a significant source of openings. In most occupations, more workers are needed to replace those who retire, die, or leave the occupation than are needed to fill jobs created by growth. Consequently, even some declining occupations offer employment opportunities.

To estimate replacement openings, the Bureau has developed tables of working life based on actuarial experience for deaths and on decennial census data for general patterns of labor force participation by age and sex. Withdrawals from each occupation are calculated separately for men and women by age group and used to compute an overall separation rate for the occupation. These rates are used to estimate average annual replacement needs for each occupation over the projection period.

The Bureau is currently analyzing data from the 1970 Census to determine the effect of occupational transfers on job openings. These transfers have not been taken into account in calculating replacement needs. Some data on occupational transfers have been published in two *Monthly Labor Review* articles, "Occupational Mobility in the American Labor Force" and "Occupational Mobility of Health Workers," January and May 1977, respectively.

Supply. Supply estimates used in analysis of certain *Handbook* occupations represent the numbers of workers who are likely to seek entry to a particular occupation if past trends of entry to the occupation continue. These estimates are developed independently of the demand estimates. Thus, supply and demand are not discussed in the usual economic sense in which wages play a major role in equating supply and demand. Statistics on college enrollments and graduations by field are the chief sources of information on the potential supply of personnel in professional, technical, and other occupations requiring extensive formal education. Data on persons completing apprenticeship programs provide some information on new entrants into skilled trades. A Bureau publication, *Occupational Supply: Concepts and Sources of Data for Manpower Analysis* (BLS Bulletin 1816, 1974), explores several aspects of occupational supply.

TOMORROW'S JOBS

Early in human history, people entered occupations by simply following their parents into one of the relatively few occupations that existed. Boys became farmers, shepherds, priests, artisans, or traders. Girls generally became housewives, helping their husbands in their work, but having no paid occupations. Not until the Industrial Revolution did the number of possible choices begin to expand.

But as the choices have increased, so has the difficulty of making a decision. Today there are thousands of occupations—the newest *Dictionary of Occupational Titles* lists 20,000 separate titles—and a variety of education and training programs from which to choose. Many questions must be considered: What fields match one's interests and abilities? What types of education and training are required to enter particular jobs? What fields are expected to offer good prospects for employment? How do earnings compare among occupations requiring similar training? What types of employers provide which kinds of jobs? Does a particular job offer steady, year-round employment or is it affected by minor swings in the economy?

The answers to these questions change as our economy changes. Current information therefore is a necessity. While the individual occupation and industry chapters in the *Handbook* answer most of the questions raised here, two areas of particular concern, to educators and vocational planners as well as to individuals who are choosing their careers, require a broader perspective. One concerns employment projections, the other, the relationship between job prospects and education. This section focuses on these two aspects of choosing a career.

Employment Projections in a Changing Economy

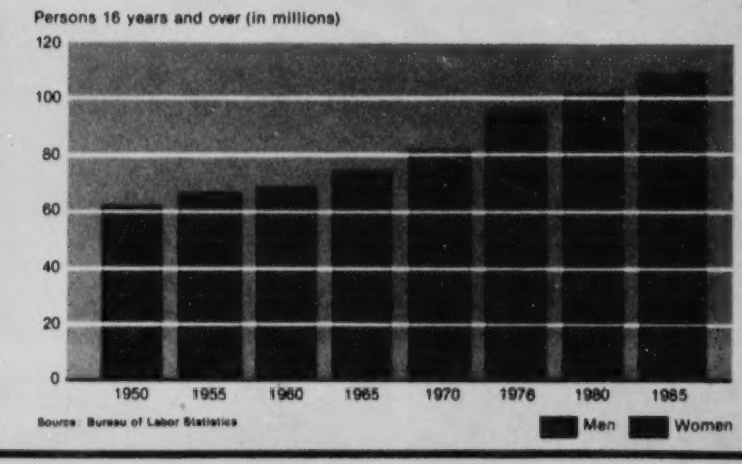
The demand for workers in any occupation depends ultimately on the tastes and desires of consumers. If a product or service is unwanted, whether by private or public purchasers, no workers will be needed to produce or provide it. Barbers would become unnecessary if people decided to cut their own hair, as would astronauts if the Federal Government abandoned its space program.

Closely interwoven with the demand for products or services is technological innovation. In the 20th century, technology has both created and eliminated hundreds of thousands of jobs. The telephone, for example, gave birth to an entire industry at about the same time that the automobile put stable owners and carriage manufacturers out of business. Changes in the way businesses are organized and managed have had similar effects; the rise of supermarket chains has drastically reduced the number of self-employed grocers.

Fortunately, most of the factors that alter the demand for workers in various occupations do not change overnight. Shifts in the state of the economy, the introduction of new technology, and the development of new organization and management techniques generally occur in an orderly, fairly predictable fashion. Although no one can forecast the future with certainty, it is possible to make industry and occupation employment projections that are useful to educators, vocational planners, and individuals who are planning their careers. The economic and statistical analysis used by the Bureau of Labor Statistics to develop its projections is described in some detail in a separate introductory section.

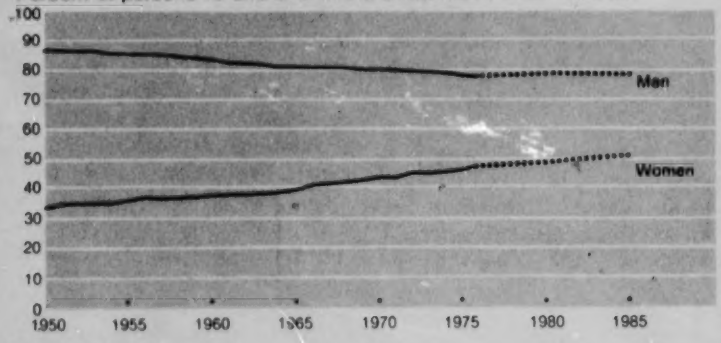
In 1985, approximately 104.3 million persons will be in the civilian labor force. This is an 19-percent increase over the 1976 level of 87.5 million. As shown in chart 1, the size of the civilian labor force increased sharply after 1960, largely due to the increase in the number of women en-

Civilian labor force growth, 1950-76 and projected 1980 and 1985 — 1



The percent of women who are in the labor force has been increasing, while the percent of men has been declining 2

Percent of persons 16 and over in the civilian labor force 1950-85



Source: Bureau of Labor Statistics

tering the labor market. The labor force participation rate for women has continued to rise even while the rate for men has declined. (See chart 2.)

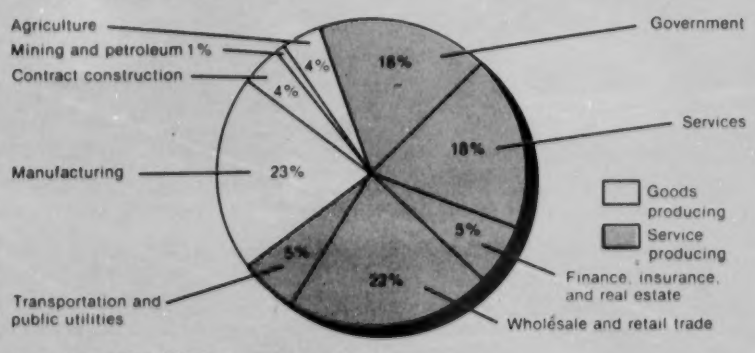
Industrial Profile

Economists customarily divide our economy into nine industry categories under two broad groups—goods producing and service producing. Most of the Nation's workers currently are employed in industries that provide services, such as education, health care, trade, repair and maintenance, government, transportation, banking, and insurance. The production of goods through farming, construction, mining, and manufacturing requires only about one-third of the country's work force. (See chart 3.)

As shown in chart 4, employment in the goods-producing industries has remained relatively constant since World War II, whereas the service-producing industries have expanded rapidly. Among the factors contributing to this rapid growth were the migration from rural to urban areas and the accompanying need for more local government services, and rising incomes and living standards that resulted in a demand for improved health and education services. These factors are expected to continue to cause the demand for services to grow.

Where people work, 1976 3

Wage and salary workers except agriculture, which includes self-employed and unpaid family workers



Source: Bureau of Labor Statistics

Service-Producing Industries. Employment in the service-producing industries is expected to increase from 56.1 million workers in 1976 to 71.0 million in 1985, an increase of 26 percent. Of course, growth rates will vary among the industries within this group. (See chart 5.)

Trade, the largest of the service industries, is expected to grow by about 20 percent between 1976 and 1985, from 17.7 million to 21.3 million workers.

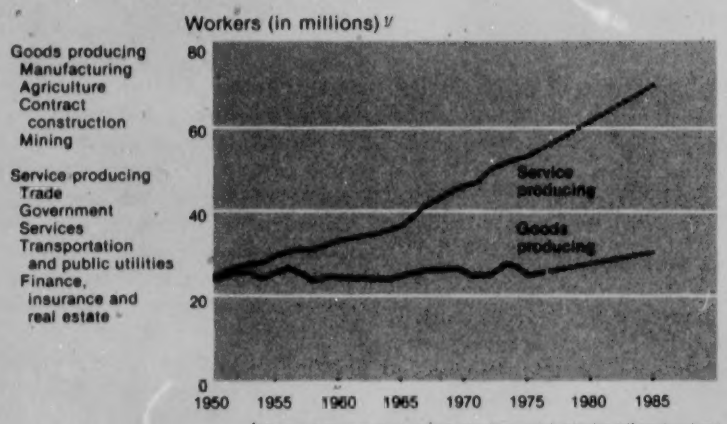
Both wholesale and retail trade have increased as population has grown and as rising incomes have enabled people to buy a greater number and variety of goods. Retail trade has grown more rapidly than wholesale trade as the expansion of the suburbs has created a demand for more shopping centers. Although self-service is expected to become more prevalent, employment in retail trade nonetheless will continue to grow faster than in wholesale trade.

Government has been the second fastest growing service industry. Employment in State and local governments doubled between 1960 and 1976. Growth has been greatest in agencies providing education, health, sanitation, welfare, and police and fire protection. Federal Government employment has increased only 20 percent during the same period.

Between 1976 and 1985, employment in government is expected to rise 22 percent, from 14.9 million to 18.3 million workers. This growth rate is less than that expected for services as a whole. Although State and local governments will continue to be the major source of jobs, the budget problems many local governments now face are expected to retard the expansion of some government programs.

Service industries have been the fastest growing group in the service-producing category, nearly doubling in employment between 1960 and 1976. The growing need for health

Industries providing services offer more jobs than those providing goods 4



1/ Wage and salary workers, except agriculture, which includes self-employed and unpaid family workers.

Source: Bureau of Labor Statistics

care, maintenance and repair, advertising, and commercial cleaning services has been the primary force behind this growth.

In the future, service industries are expected to continue their rapid growth—employment is projected to increase from 14.6 million workers in 1976 to 20.6 million in 1985. This projected growth rate of 40 percent is nearly twice as rapid as that of the service-producing industries as a group. Employment requirements in health care are expected to grow rapidly due to population growth—in particular the growth in the number of elderly persons—and rising incomes that increase people's ability to pay for medical care. Business services, including accounting, data processing, and maintenance, also are expected to grow rapidly.

Transportation and public utility industries experienced a much slower growth rate between 1960 and 1976 than any of the other service-producing industries. This has largely been due to employment declines in the railroad and water transportation industries.

Although employment in the railroad and water transportation industries is expected to continue to decline (but at a slower rate than before), other industries in this group will experience increases. The air transportation industry, which nearly doubled in size between 1960 and 1976, will continue to grow at a moderate pace.

Between 1976 and 1985, employment in transportation and public utilities industries is expected to rise from 4.5 million to 5.2 million workers, an increase of 16 percent.

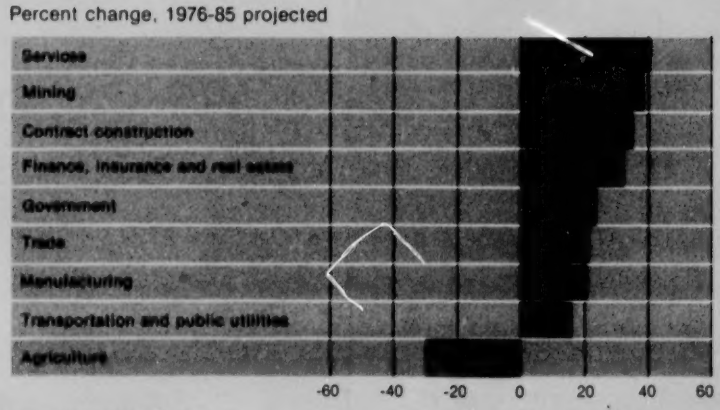
Finance, insurance, and real estate will grow faster than services as a whole. Employment is expected to increase from 4.3 million to 5.6 million workers between 1976 and 1985, an increase of 30 percent.

Within this group, the two fastest growing industries have been banking and credit agencies. Employment in banking nearly doubled between 1960 and 1976, reflecting a growing population that increasingly pays its bills by check. Employment requirements also grew as banks began to provide more services, particularly the bank credit cards, and remained open longer hours. Population growth also meant an increased demand for the services of finance companies, savings and loan associations, and other credit agencies. These trends are expected to continue through the mid-1980's.

Goods-Producing Industries. Employment in the goods-producing industries—agriculture, mining, construction, and manufacturing—has changed very little since 1960. Significant gains in productivity resulting from automated production, improved machinery, and other technological breakthroughs have permitted large increases in output without additional workers. Between 1976 and 1985, employment in goods-producing industries is expected to increase by about 17 percent, from 26.6 million to 31.1 million workers.

Growth rates will vary from industry to industry within this group. Employment in *agriculture*, which has long been declining, stabilized at about 3.5 million workers between

Through the mid-1980's employment growth will vary widely by industry 5



Source: Bureau of Labor Statistics

1970 and 1975, but dropped again to 3.3 million in 1976. Since the 1950's, the trend toward fewer but larger farms and the use of more and better machinery has reduced the need for farmers and farmworkers. So too has the development of improved hybrid crops. Recently, for example, a hybrid tomato was developed that has a harder skin and can be machine harvested.

Although employment on farms has declined, rapid mechanization combined with better fertilizers, feeds, pesticides, and hybrids have created large increases in output. The worldwide demand for food is rising rapidly as population increases, but production is expected to continue to rise without reversing the employment decline in agriculture. Between 1976 and 1985, employment is expected to drop about 29 percent, from 3.3 million to 2.3 million workers.

Mining, once declining in employment, increased abruptly between 1970 and 1976, experiencing a 26-percent growth rate during this period and matching the growth rate of the fastest growing industry group, services. Most of this growth was a direct result of our need for additional energy. Employment in the oil and gas extraction industry rose 33 percent between 1970 and 1976, and is expected to rise another 70 percent by 1985. Coal, the most commonly used alternative energy source, has been and will continue to be in great demand.

Employment in mining is expected to grow 39 percent between 1976 and 1985, from 0.8 to 1.1 million workers.

Contract construction, which grew fairly rapidly between 1960 and 1968, stagnated between 1968 and 1976. The earlier growth, which reflected an increasing need for houses, apartment and office buildings, highways, and shopping centers, was dampened by the economic downturn that began in the late 1960's.

Buildings that had been vacant are now filling up, however, and as our economy recovers, employment in construction is expected to increase, rising by 38 percent between 1976 and 1985, or from 3.6 million to 4.9 million workers.

Manufacturing employment, also adversely affected by the economic conditions of the early 1970's, is expected to grow from 18.9 million to 22.8 million between 1976 and 1985, an increase of 20 percent.

Manufacturing is divided into two broad categories, durable goods manufacturing and nondurable goods manufacturing. Employment in durable goods manufacturing is expected to increase by about 25 percent, from 11.0 million to 13.8 million workers, while employment in nondurable goods manufacturing is expected to increase by only 13 percent, from 7.9 million to 9.0 million workers.

Growth rates will vary among individual industries within each of these categories. In nondurable goods industries, for example, employment in tobacco manufacturing is expected to decline, while a moderate rise in employment is projected for the synthetic fiber industry. Among durable goods manufacturing industries, medical instrument manufacturing is expected to undergo a rapid employment increase; motor vehicle manufacturing will employ about the same number of workers in 1985 as it did in 1976.

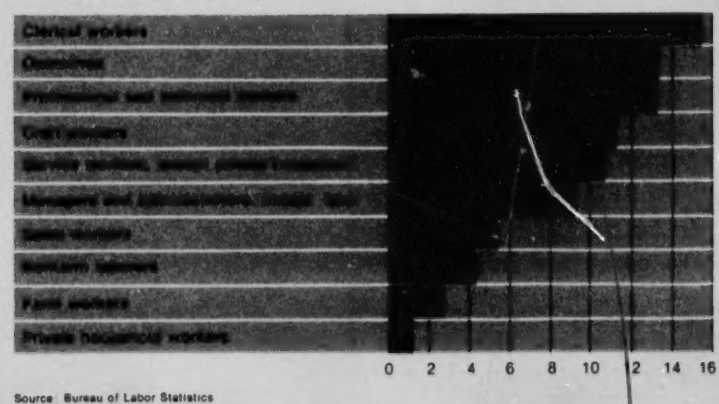
Occupational Profile

Customarily, occupations also are divided into several groups. White-collar workers are those in professional and technical, clerical, sales, and managerial jobs. Blue-collar workers are those in craft, operative, and laborer jobs. Service workers and farm workers constitute separate groups. Chart 6 illustrates the occupational profile in 1976.

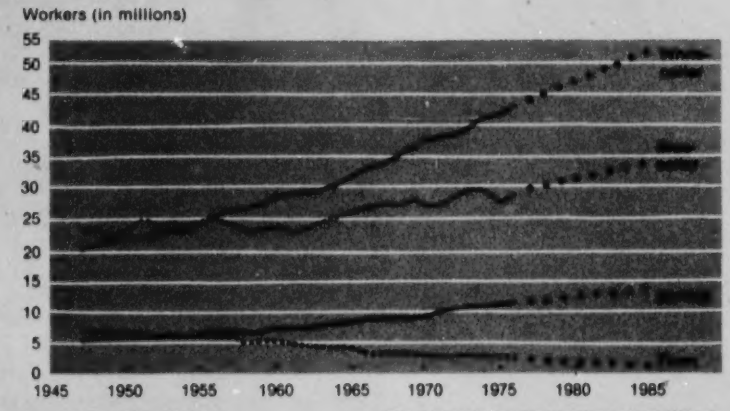
Growth rates among these groups have differed markedly, as shown in chart 7. Once a small proportion of the total labor force, white-collar workers have steadily increased in importance until they now represent about half of the total. The number of service workers also has risen rapidly, while the blue-collar work force has grown only slowly and the number of farmworkers has declined.

Most of these changes in occupational employment have been due to variations in the growth rates of industries. Every industry group has a unique occupational pattern. (See chart 8.) Construction, for example, employs mostly blue-collar workers, while finance, insurance, and real estate is predominantly a white-collar industry group. Growth in the construction industry would result in an increase in employment of blue-collar workers. The same would be true for growth in mining, manufacturing, or transportation—industries that also employ mostly blue-collar workers. The magnitude of the change

Employment in major occupational groups 6



The shift toward white-collar occupations will continue through 1985 7



Source: Bureau of Labor Statistics Note: 14- and 15- year olds are included prior to 1958 only.

would depend on both the rate of growth and the size of the industry.

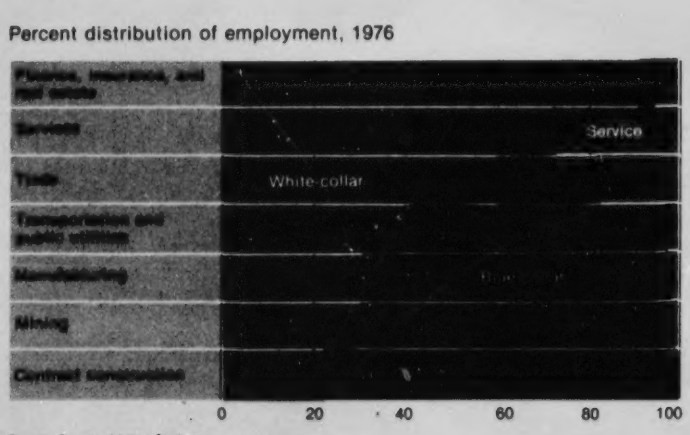
The following sections describe the changes that are expected to occur among the broad occupational groups between 1976 and 1985. (See also chart 9.)

Professional and technical workers include a wide range of workers, many of them highly trained. Among this group are scientists and engineers, medical practitioners, teachers, entertainers, pilots, and accountants. Employment in this group is expected to grow by about 18 percent between 1976 and 1985, rising from 13.3 million to 15.8 million workers.

Greater efforts in energy production, transportation, and environmental protection will contribute to a growing demand for scientists, engineers, and technicians. The medical professions can be expected to grow as the health services industry expands. The demand for professional workers to develop and utilize computer resources also is projected to grow rapidly.

Some occupations will offer less favorable job prospects, in many cases because the supply of workers exceeds the available openings. Teachers will continue to face competition, as will artists and entertainers, airline pilots, and oceanographers.

Industries differ in the kinds of workers they employ 8



Source: Bureau of Labor Statistics

Managers and administrators include workers such as corporate executives, school and health services administrators, department store managers, and self-employed business operators. This group is expected to grow from 9.3 million to 11.3 million workers, an increase of 21 percent. The rapidly expanding service industries are expected to offer more jobs for managers than the slowly growing manufacturing industries.

Changes in business size and organization have resulted in differing trends for self-employed and salaried managers. The number of self-employed managers will continue to decline as many areas of business are increasingly dominated by large corporations and chain operations. Some kinds of small businesses, such as quick-service groceries and fast-food restaurants, still will provide opportunities for self-employment, however. The demand for salaried managers will continue to grow rapidly as firms increasingly depend on trained management specialists, particularly in highly technical areas of operation.

Clerical workers constitute both the largest and the fastest growing occupational group. Employment in these occupations is expected to grow about 29 percent between 1976 and 1985, rising from 15.6 million to 20.0 million workers.

New developments in computers, office machines, and dictating equipment will greatly affect employment in many occupations within this group. As computers are used more extensively to store information and perform billing, payroll, and other calculations, employment of file clerks and many types of office machine operators will level off or decline. At the same time, however, the need for computer and peripheral equipment operators will increase. Dictation machines, which have sharply reduced the need for stenographers, will continue to adversely

affect employment prospects for workers in this occupation. The sole exception will be stenographers who are trained as court reporters.

Many types of clerical workers, however, will not be affected by technological innovations because their jobs involve a high degree of personal contact. Substantial growth is anticipated for secretaries, typists, and receptionists, largely as a result of growth in the expanding business services and medical and health care services industries. Counter and fountain workers also are expected to increase as the restaurant industry grows.

Sales workers are employed primarily by retail stores, manufacturing and wholesale firms, insurance companies, and real estate agencies. Employment of this group is expected to grow from 5.5 million to 6.4 million workers, an increase of 17 percent.

Much of the growth of sales workers will be due to expansion in the retail trade industry, which employs about one-half of these workers. The demand for both full- and part-time sales workers in retail trade is expected to increase as our growing population requires an increasing number of shopping centers and stores. Despite the widespread use of laborsaving merchandising techniques, such as self-service and computerized checkout counters, suburban expansion and longer operating hours will cause employment to increase.

Craft workers include a wide variety of highly skilled workers, such as carpenters, tool-and-die makers, instrument makers, all-round machinists, electricians, and automobile mechanics. Between 1976 and 1985, employment of this group is expected to increase 22 percent, from 11.3 million to 13.7 million workers.

Construction workers and mechanics, the two largest occupations within this group, are expected to account for about two-thirds of the employment gain for craft workers, and blue-collar worker supervisors and metalcraft workers for most of the remainder.

Nearly all construction trades are expected to grow, but particularly rapid increases are anticipated for heavy equipment operators, plumbers, ironworkers, roofers, and cement masons. Among mechanics and repairers, the most rapid increases will be for workers who repair computers, office machines, air conditioners, and industrial machinery.

In contrast, a continuation of the long-run employment decline in the railroad industry will lead to the decline of some craft occupations concentrated in that industry, such as railroad and car shop repairers. Because of advances in printing technology, very little growth is anticipated in printing crafts.

Operatives are the largest blue-collar group, including workers such as assemblers, packers, truck and bus drivers, and many types of machine operators. Employment of operatives is tied closely to the production of goods, because the majority of these workers are employed in manufacturing industries. The projected slow growth of manufacturing, along with improved production processes, will hold down the demand for these workers. Textile operatives, such as spinners, knitters, and weavers, are expected to decline due to increasing use of machinery in the textile industry.

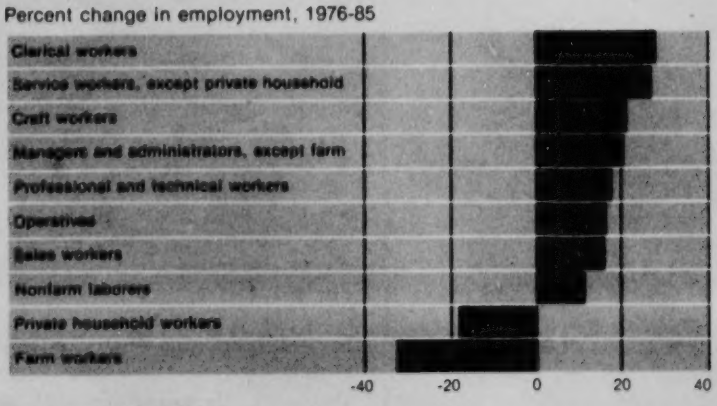
Outside of manufacturing, employment of most transportation operatives, such as truckdrivers and bus drivers, will increase as the transportation industry grows. An exception will be brake and switch operators; these occupations are expected to decline along with the railroad industry.

Employment of operatives is expected to rise from 13.4 million to 15.6 million workers between 1976 and 1985, an increase of 17 percent.

Laborers, (except farm) include workers such as garbage collectors, construction laborers, freight and stock handlers, and equipment washers. Employment in this group is expected to grow only slowly as machinery increasingly replaces manual labor in construction and manufacturing, the two largest employers of these workers. Power-driven equipment, such as forklift trucks, cranes, and hoists, will handle more and more material in factories, loading docks, and warehouses. Other machines will do excavating, ditch digging, and similar work. Between 1976 and 1985, employment of laborers is expected to increase 11 percent, from 4.3 million to 4.8 million workers.

Service workers include a wide range of workers—firefighters, janitors, cosmetologists, private household workers, and bartenders are a few examples. These workers, most of whom are employed in the service-producing industries, make up one of the fastest growing occupational groups.

Through the mid-1980's employment growth will vary widely among occupational groups 9



Source: Bureau of Labor Statistics

Some of the main factors that are expected to increase the need for these workers are the rising demand for medical care; the greater need for commercial cleaning and protective services; and the more frequent use of restaurants, beauty salons, and leisure services as incomes rise. The employment of private household workers, however, will continue to decline despite a rising demand for their services, because low wages and the strenuous nature of the work make this occupation unattactive to many people.

Employment of service workers is expected to increase 23 percent between 1976 and 1985, from 12.0 million to 14.8 million workers.

Farm workers include farmers and farm operators, as well as farm laborers. Employment of these workers has declined for decades as farm productivity has increased as a result of the trend toward fewer but larger farms, the use of more and better machinery, and the development of new feeds, fertilizers, and pesticides. Between 1976 and 1985, the number of farmworkers is expected to decline 34 percent, from 2.8 million to 1.9 million workers.

Job Openings

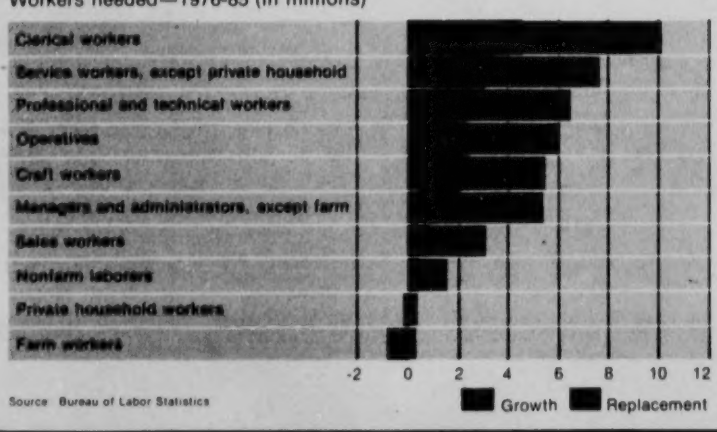
The rate of employment growth in an occupation is only one indicator of future job prospects; another indicator is the total number of job openings expected in the occupation. The total includes not only openings resulting from employment growth, but also those resulting from labor force separations (retirements and deaths) and transfers to other occupations.

Between 1976 and 1985, retirements and deaths alone are expected to account for nearly two-thirds of all job openings. (See chart 10.) The need to replace workers who retire or die will be a more significant source of job openings than employment growth in every major occupational group, and in most individual occupations.

Furthermore, a large occupation that is growing slowly may offer more openings than a fast-growing small one. For example, among the major occupational groups, total openings for operatives will exceed total openings for craft workers, despite the fact that employment of craft workers is expected to grow at a faster rate.

Many job openings also are created because of occupational transfers. When a technician is upgraded to an engineer, for example, a job opening for a technician is created. Of course, this shift also adds to the supply of engineers. Data for estimating occupational losses and gains resulting from transfers are not yet available, but work is continuing towards the development of such data.

Job openings are determined by replacement plus growth **10**



Source: Bureau of Labor Statistics

Education and Employment

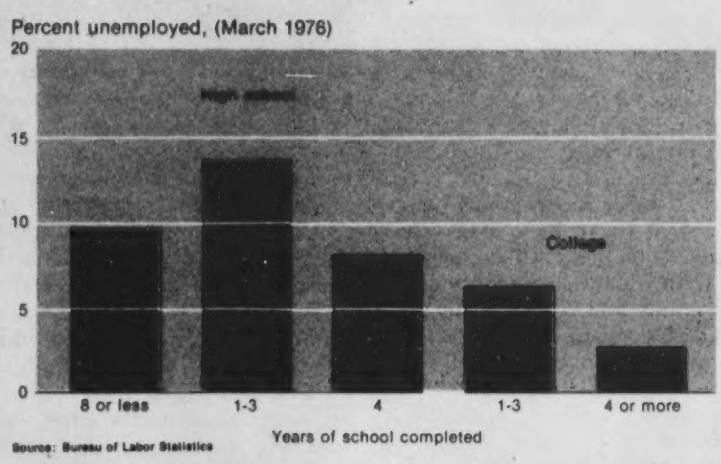
A high school diploma by itself is not sufficient preparation for many occupations. But neither is a college degree. Different fields of work require different types of training. Just as there are occupations that require college degrees, so too there are occupations for which technical training, work experience, or training in a particular skill is the most important entry requirement. Employers always wish to hire the best qualified persons available, but this does not mean that they always choose those applicants who have the most education. The type of education and training an individual has had is as important as the amount. For this reason, a vital part of the career planning process is deciding what type as well as how much education and training to pursue.

Persons who have definite career goals may not find this decision difficult. Many occupations have specific education requirements. Physicians, for example, must generally complete at least 3 years of college, 4 years of medical school, and in most States 1 year of residency. Cosmetologists are required to complete a State-approved cosmetology course that generally lasts 18 months.

But for most people, the decision is more difficult. Either they have yet to choose a field of work, or the field they have selected may be entered in a variety of ways. Some may know only that they want jobs that provide status and large incomes, for example. Or, an individual may wish to be an auto mechanic but cannot decide whether to leave high school and learn on the job, or graduate and attend a vocational school, or seek an apprenticeship.

Making this type of decision requires specific information about the types of education and training preferred for various occupations, and a knowledge of one's own abilities and aspirations. Information on how to enter each of the occupations included in the *Handbook* is contained in the individual occupational statements, but general information on the relationship of employment prospects to education also is useful.

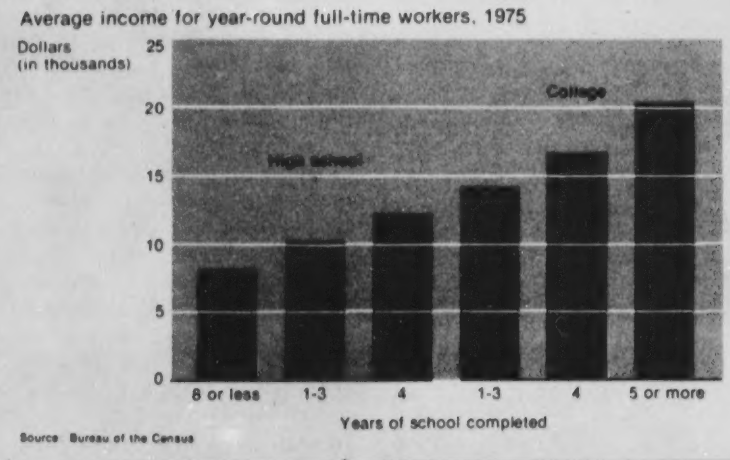
The unemployment rate is lowest for persons with a college education **11**



Persons contemplating dropping out of high school should recognize that a high school education has become standard. The educational attainment of the labor force has risen from 10.9 years of school in 1952 to 12.6 in 1976. Thus, nongraduates are likely to be at a serious disadvantage when seeking jobs that offer better pay or advancement opportunities, unless they have participated in a training program specific to the occupation they wish to enter. As shown in chart 11, the unemployment rate is much higher for persons who did not finish high school than for those who did.

For many individuals, the decision they face is whether to extend their education beyond high school by going to college or by pursuing some other postsecondary education or training program. Looking again at chart 11, for individuals who have graduated from high school, the unemployment rate drops steadily as the amount of education completed increases. In addition, as chart 12 shows, average yearly income rises with the number of years of school completed. In 1975, college graduates, on the average, earned over one-third more than high school graduates, while persons with 5 years or more of college earned one-fifth more than those with 4 years of college.

Income increases as the number of years of schooling increases **12**



Although college graduates do earn more, on the average, than high school graduates, there are numerous well-paying occupations that do not require a college degree. Workers in the construction crafts and in mechanic and repairer occupations, for example, generally are high school graduates, yet many earn more than workers in some jobs that require a college degree. In fact, earnings in many occupations not requiring college degrees have increased faster than earnings in occupations that do require a degree. Chart 13 shows how much the difference between the earnings of high school graduates and college graduates has narrowed.

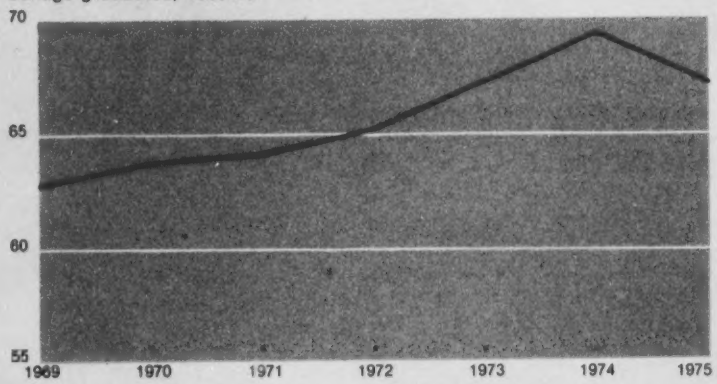
Although data are not available on the earnings of high school graduates who have completed other postsecondary education programs, it is likely that most of those who earn relatively high incomes have obtained some type of additonal education or training.

Traditionally, a college education has been viewed as a gateway to better pay, higher status, and more challenging work. As the opportunity to obtain a college education has become more widespread, more high school graduates have attended college. Accordingly, the proportion of workers in the labor force who have completed at least 4 years of college rose from 7.9 percent to 16.5 percent between 1952 and 1976, and college graduates are expected to constitute 20 percent of the labor force by 1985. Recent experience has shown, however, that the traditional view has not been matched by reality.

Between 1970 and 1976, the proportion of workers having 4 years or more of college increased by more than 60 percent in clerical, sales, service, and blue-collar occupations—areas that have employed very few college graduates in the past. This

Earnings of high school graduates have increased relative to earnings of college graduates 13

Earnings of high school graduates as a percent of earnings of college graduates, 1969-75



Source: Bureau of the Census

"spillover" reflects, at least in part, the economic conditions of the 1970-75 period. Cutbacks in the aerospace industry and the recession of 1970-71, followed by an oil embargo in 1972-73 and recession in 1974-75, dampened the economy's growth during the first half of this decade.

Analysis of the future demand for college graduates, and of future supply, indicates that more students are expected to graduate, and more persons currently holding degrees are expected to reenter the labor force, than will be needed to fill jobs that currently demand a college degree.

Prospects are no brighter for many individuals who hold advanced degrees. Colleges and universities, the primary employers of this group, have been faced with declining enrollments and budget cuts in recent years. Their need for teaching and research staff is not expected to grow as rapidly as the number of graduates seeking these positons. Except for persons whose degrees are in areas demanded by business and industry, advanced degree holders may have to take jobs that once went only to graduates who had bachelor's degrees.

Not all occupations requiring college degrees will be overcrowded, however. Nor will there be a lack of demand for graduates of other postsecondary education programs. Many of the occupations that have grown most rapidly or have provided large numbers of job openings have required vocational, apprenticeship, or junior college education. Science and health technicians have been increasingly in demand, as have television and radio service technicians, data processing machine repairers, and air-conditioning mechanics. Technological advances, in particular the computer, have made many office jobs more complicated, thus requiring people who hold these jobs to have a higher level of skill.

Persons wishing to enter these and other occupations have found postsecondary training helpful because employers prefer to hire applicants who have had training in these areas, rather than provide such training themselves. Over the past 10 years, enrollments in public vocational schools, for example, have tripled, while the number of persons registered in apprenticeship programs has jumped 40 percent.

The demand for workers in these and other occupations requiring technical, vocational, or apprenticeship training is expected to continue to rise through the mid-1980's.

The need for workers who have some type of postsecondary training definitely is expanding. But the decision to go to college is an individual matter. Persons who choose occupations that require college degrees should not necessarily be discouraged from pursuing careers that they believe match their interests and abilities. They may wish, however, to acquire more information on the employment outlook for their fields, and to retain the option of switching to related occupations that offer better opportunities. The introductory section of the *Occupational Outlook Handbook for College Graduates* contains a detailed discussion of the job prospects for college graduates.

Individuals who have less clear-cut occupational goals may wish to review their reasons for going to college. College can provide many valuable opportunities for personal growth and self-discovery, as well as the chance to increase one's knowledge of particular subject areas. Attending college for personal reasons alone can be worthwhile, but a student solely interested in career preparation may find alternative types of education and training programs more appropriate—either as an addition to or as a substitute for college attendance.

Whatever one's goals and aspirations, beginning the planning process early allows students time to consider all the choices that are available for preparing for tomorrow's jobs.

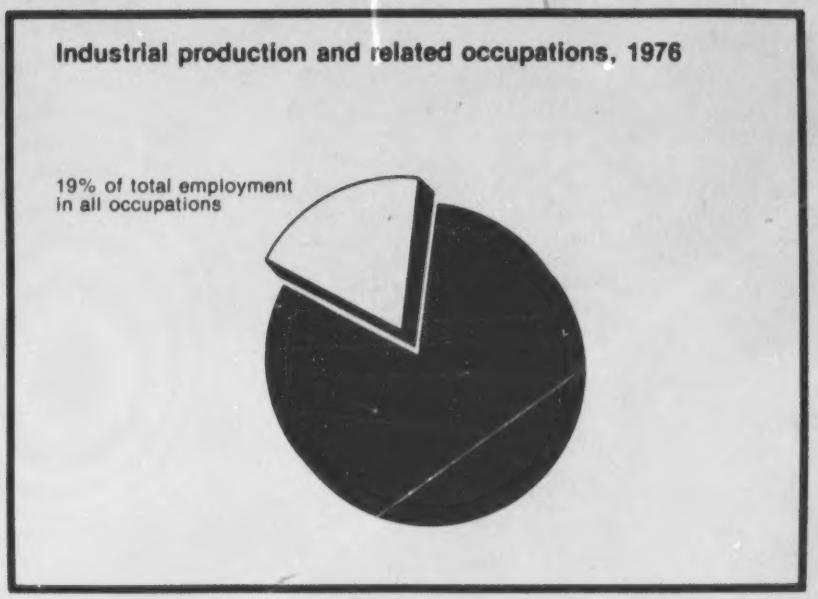
The Outlook for Occupations

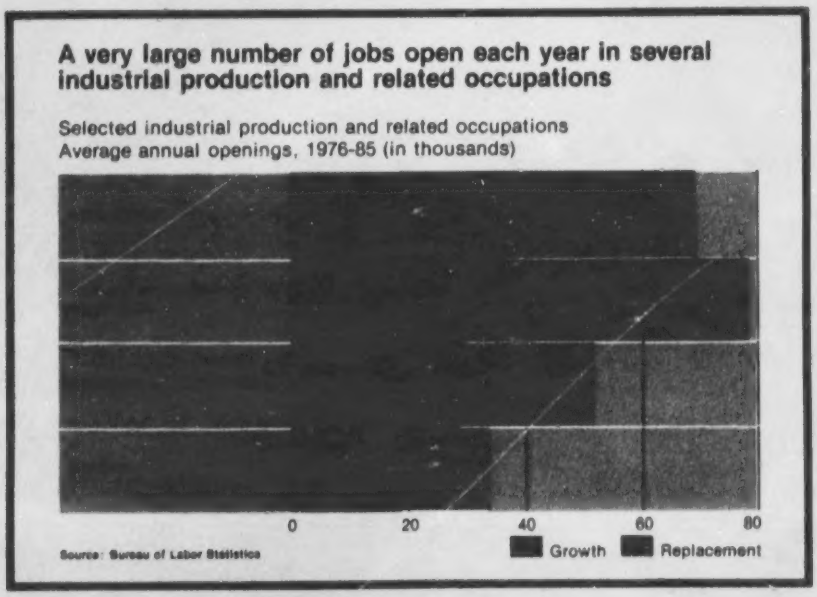
INDUSTRIAL PRODUCTION AND RELATED OCCUPATIONS

Cars, newspapers, radios, bathtubs, guided missiles, eating utensils, books, and pencil sharpeners all have at least one thing in common. They, and almost all other products that we use, are made by the millions of workers in industrial production and related occupations.

Most of these skilled and semiskilled blue-collar workers are employed in factories in the mass production of goods. Others work outside of manufacturing in a wide variety of activities ranging from showing motion pictures to shoeing horses.

Because mass production would not be possible without interchangeable parts, workers in the machining and foundry occupations play a basic role in the production process. These workers make the tools, dies, molds, cores, and other items that can be used to make hundreds or even thousands of identical parts. Assemblers may then put these parts together to make automobiles, television sets, and hundreds of other products. If the parts or finished products require painting, production painters do that job. After the products are made, inspectors examine and test them to insure quality.





Other factory workers are not directly involved in the production process, but support it in some way. Stationary engineers, for example, operate soilers and other equipment used to heat and air-condition factories and other buildings, Millwrights move and install heavy machinery used in the production process and power truck operators move materials about the plant.

Printing is another type of mass production. Printing craft workers operate the machinery used to print newspapers, books, and other publications.

Industrial workers also are employed outside of manufacturing in a variety of activities. Automobile painters, for example, restore the finish on old and damaged cars. Photographic laboratory workers develop film and make prints and slides.

Most jobs in industrial production do not require a high school diploma. However, many employers prefer high school or vocational school graduates who have taken courses such as blueprint reading and machine shop.

Semiskilled workers, such as assemblers and power truck operators, ordinarily need only brief on-the-job training. Skilled workers, such as stationary engineers and machinists, require considerable training to qualify for their jobs. Many learn their trades on the job, but training authorities generally recommend completion of a 3- or 4-year apprenticeship program as the best way to learn a skilled trade.

This chapter includes statements on 21 industrial production and related occupations. Many other workers who are involved in industrial production are described elsewhere in the *Handbook* because of their close association with particular occupational groups. For example, engineers are included in the chapter on scientific and technical occupations.

FOUNDRY OCCUPATIONS

Many of the products that we use every day are made by casting or have parts that are made by casting. Casting is a method of forming metal into intricate shapes by pouring molten metal into carefully prepared molds and allowing it to solidify. Foundry workers produce metal castings for numerous industrial household products that range from machine tools and automobiles to bathtubs.

The *patternmaker*, the *molder*, and the *coremaker* each play an important part in the process. A *patternmaker* makes a wood or metal model of the casting. A *molder* places it in a box and packs sand around the model to form a mold. If the casting is to have a hollow section, a *coremaker* makes a core of packed and hardened sand that is positioned in the mold before the molten metal is poured in.

In 1976, about 18,000 patternmakers, 53,000 molders, and 22,000 coremakers worked in the foundry industry. About three-fourths of them worked in shops that make and sell castings. The remainder worked in plants that make castings to use in their final products, such as plants operated by manufacturers of automobiles or machinery.

A high school education is the minimum requirement for an apprenticeship in patternmaking. Some highly skilled molding and coremaking jobs also may require a high school education, but an eighth grade education may be enough for entry into many molding and coremaking jobs.

The production and use of castings are expected to grow significantly through the mid-1980's. However, because of automation and other laborsaving improvements in production methods, employment of patternmakers, coremakers, and molders is expected to increase only about as fast as the average for all occupations. In addition to those job openings that result from employment growth, other openings will arise from the need to replace experienced workers who die, retire, or transfer to other occupations. The number of openings may fluctuate from year to year because foundry employment is very sensitive to ups and downs in the economy.

Patternmakers, molders, and coremakers are discussed in detail in the following statements. (For a general description of many other jobs involved in metal casting, see the statement on foundries elsewhere in the *Handbook*.)

Sources of Additional Information

For details about training opportunities for patternmakers, molders, and coremakers, contact local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency, or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

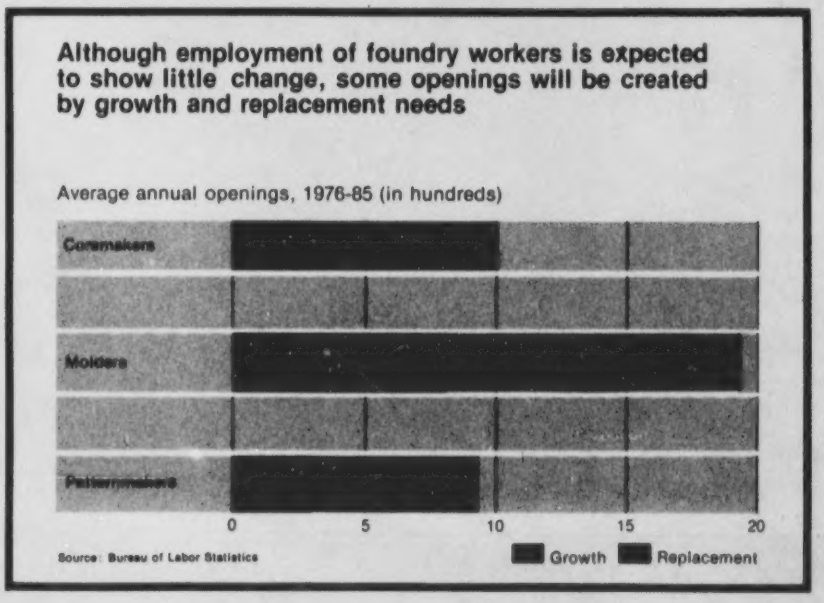
International Molders' and Allied Workers' Union, 1225 E. McMillan St., Cincinnati, Ohio 45206.

PATTERNMAKERS

Nature of the Work

Foundry patternmakers are highly skilled craftworkers who make the patterns used in making molds for metal castings. Most of the workers in the occupation are *metal patternmakers* (D.O.T. 600.280); a smaller number are *wood patternmakers* (D.O.T. 661.281). Some patternmakers work with both metal and wood as well as with plaster and plastics.

Patternmakers work from blueprints prepared by engineers or drafters. They make a precise pattern for the product, carefully checking each dimension with instruments such as micrometers and calipers. Precision is important because any imperfections in the pattern will be reproduced in the castings made from it.



Wood patternmakers select the wood stock, lay out the pattern, and saw each piece of wood to size. They then shape the rough pieces into final form with various woodworking machines, such as lathes and sanders, as well as many small handtools. Finally, they assemble the pattern segments by hand, using glue, screws, and nails.

Metal patternmakers prepare patterns from metal stock or from rough castings made from a wood pattern. To shape and finish the patterns, they use many metalworking machines, including lathes, drill presses, shapers, milling machines, power hacksaws, and grinders. They also use small handtools, such as files and rasps.

Training, Other Qualifications, and Advancement

Apprenticeship is the best means of qualifying as an experienced patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking, it is difficult to learn the trade on the job, but in some instances skilled machinists have been able to transfer to metal patternmaking with additional on-the-job training or experience. High school courses in mechanical drawing, blueprint reading, and shop mathematics are helpful to persons interested in becoming patternmakers. In addition, vocational and technical school training in patternmaking, metalworking, and machining provide useful preparation for an apprentice, and may be credited toward completion of the apprenticeship.

The usual apprenticeship period for patternmaking is 5 years; however, a few apprenticeships last only 3 or 4 years. Each year at least 144 hours of classroom instruction usually are provided. Apprenticeship programs for wood and metal patternmaking are separate. Employers almost always require apprentices to have a high school education.

Apprentices begin by helping experienced patternmakers in routine duties. They make simple patterns under close supervision; as they progress, the work becomes increasingly complex and the supervision more general. Patternmakers earn higher pay as their skill increases, and some become supervisors.

Patternmaking, although not strenuous, requires considerable standing and moving about. Manual dexterity is especially important because of the precise nature of the work. The ability to visualize objects in three dimensions also is important when reading blueprints.

Patternmakers must carefully check each dimension.

Employment Outlook

Employment of foundry patternmakers is expected to increase only about as fast as the average for all occupations through the mid-1980's despite the anticipated large increases in foundry production. The increased use of metal patterns will allow production to increase faster than employment. Metal patterns, unlike wooden ones, can be used again and again, thus reducing the number of patterns that have to be made.

In addition to those openings created by employment growth, some job openings will arise because of the need to replace experienced patternmakers who retire, die, or transfer to other occupations. Most of these openings will be for metal patternmakers. The number of openings may fluctuate from year to year since the demand for foundry products is sensitive to changes in the economy.

Because patternmakers learn either basic metalworking or woodworking, they are prepared for jobs in related fields when patternmaking employment is not available. Wood patternmakers can qualify for woodworking jobs such as cabinetmaker, and metal patternmakers can transfer their skills to metalworking jobs such as machinist.

Earnings and Working Conditions

Patternmakers generally have higher earnings than other production workers in manufacturing. In January 1976, average straight-time hourly earnings of wood patternmakers ranged from $6 in gray iron and

malleable iron foundries, to $6.25 in nonferrous foundries, according to a wage survey made by the National Foundry Association. In comparison, all production workers in manufacturing industries averaged $5.19 an hour.

Patternmakers work indoors in well-lighted, well-ventilated areas. The rooms in which they work generally are separated from the areas where the casting takes place, so they are not exposed to the heat and noise of the foundry floor.

For sources of additional information, see the introductory section of this chapter.

MOLDERS

Nature of the Work

One of the oldest known methods of making metal products is by metal casting, or the process of pouring molten metal into a previously made mold and allowing the metal to harden in the shape of the mold. There are several different ways of making molds, but sand molding is the most common. In sand molding, molders make the mold by packing and ramming specially prepared sand around a pattern—a model of the object to be duplicated—in a box called a flask. A flask usually is made in two parts that can be separated to remove the pattern without damaging the mold cavity. When molten metal is poured into the cavity, it solidifies and forms the casting. (Other types of molds and molding processes are described in the foundry industry section of the *Handbook*).

Technologically advanced molding machines that pack and ram the sand mechanically are now used to make most molds. Thus, most of the workers in this occupation are machine molders. *Machine molders* (D.O.T. 518.782) operate machines that speed up and simplify the making of large quantities of identical sand molds. Machine molders assemble the flask and pattern on the machine table, fill the flask with prepared sand, and operate the machine with le ers and pedals. Many of these workers set up and adjust their own machines.

In a few foundries, hand molders still construct the sand molds, using primarily manual methods. Power tools, such as pneumatic rammers, and handtools, such as trowels and mallets, are used to smooth the sand. Molds for small castings usually are made on the workbench by *bench molders* (D.O.T. 518.381); those for large and bulky castings are made on the foundry floor by *floor molders* (D.O.T. 518.381). An all-round hand molder makes many different types of molds. A less skilled molder specializes in a few simple types.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprenticeship program, or equivalent experience, is needed to become a skilled hand molder. Workers with this training also are preferred for some kinds of machine molding, but in general a shorter training period is required in order to become a qualified machine molder. Some people learn molding skills informally on the job, but this way of learning the trade takes longer and is less reliable than apprenticeship.

An eighth grade education usually is the minimum requirement for apprenticeship. Many employers, however, prefer high school graduates.

Molders need good vision and manual dexterity.

Apprentices, under close supervision by skilled molders, begin with simple jobs, such as shoveling sand, and then gradually take on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. They also learn to operate the various types of molding machines. As their training progresses, they learn to make complete molds. In addition, the apprentice may work in other foundry departments to develop all-round knowledge of foundry methods and practices. The apprentice usually receives at least 144 hours of classroom instruction each year in subjects such as shop arithmetic, metallurgy, and shop drawing.

Hand molders who do highly repetitive work that requires less skill usually learn their jobs during a brief training period. Trainees work with a molder to make a particular kind of mold. After 2 to 6 months, the trainee usually is capable of making a similar mold. Most machine molding jobs can be learned in 2 to 3 months on the job.

Physical standards for molding jobs are fairly high. Hand molders stand while working, must move about a great deal, and frequently must lift heavy objects. They need good vision and a high degree of manual dexterity. Molders may advance to a specialized molding job or eventually to a supervisory position.

Employment Outlook

Employment of molders is expected to increase about as fast as the average for all occupations through the mid-1980's. Although the demand for metal castings is expected to increase significantly, the trend to more machine molding, such as the sand slinging process, and other laborsaving innovations will allow large increases in production with only moderate employment growth. In addition to job openings created by employment growth, openings will arise from the need to replace experienced molders who retire, die, or transfer to other occupations. The number of openings, however, may fluctuate greatly from year to year

because the demand for foundry products is sensitive to changes in the economy.

Earnings and Working Conditions

In January 1976, floor molders averaged $5.52 an hour and bench molders averaged $4.98, according to a wage survey made by the National Foundry Association. By comparison, production workers in all manufacturing industries averaged $5.19 an hour. Molders who were paid on an incentive basis generally had higher earnings.

Working conditions vary considerably from one foundry to another. Heat, fumes, and dust, have been greatly reduced in many plants by the installation of improved ventilation systems and air-conditioning; however, in many older foundries these still are problems.

Working in a foundry can be hazardous, and the injury rate is higher than the average for all manufacturing industries. Safety programs and safety equipment, such as metal-plated shoes, have helped reduce injuries at many foundries; however, molders must be careful to avoid burns from hot metal and to avoid cuts and bruises when handling metal parts and power tools.

For sources of additional information, see the introductory section of this chapter.

COREMAKERS

Nature of the Work

Coremakers prepare the "cores" that are placed in molds to form the hollow sections in metal castings. The poured metal solidifies around the core, so that when the core is removed the desired cavity or contour remains.

A core may be made either by hand or by machine. In both instances, sand is packed into a block of wood or metal in which a space of the desired size and shape has been hollowed out. After the core is removed from this box, it is hardened by baking or by another drying method. When hand methods are used, the coremaker uses mallets and other handtools to pack sand into the core box. Small cores are made on the workbench by *bench coremakers* (D.O.T. 518.381) and large ones are made on the foundry floor by *floor coremakers* (D.O.T. 518.381).

Machine coremakers (D.O.T. 518.885) operate machines that make sand cores by forcing sand into a core box. Some machine coremakers are required to set up and adjust their machines and do finishing operations on the cores. Others are primarily machine tenders. They are closely supervised and their machines are adjusted for them. (To see how the coremaker's job is a basic step in the casting process, read the description of sand casting given in the statement on foundries elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Completion of a 4-year apprenticeship training program or the equivalent experience is needed to become a skilled hand coremaker. Apprenticeships also are sometimes required for the more difficult machine coremaking jobs. Apprenticeships in coremaking and molding often are combined.

Experienced coremakers teach apprentices how to make cores and operate ovens. Classroom instruction covering subjects such as arithmetic and the properties of metals generally supplements on-the-job training. Coremakers earn higher pay as their skill increases, and some may advance to supervisors.

An eighth grade education usually is the minimum requirement for coremaking apprentices; however, most employers prefer high school graduates, and some employers require apprentices to have graduated from high school. Some types of hand coremaking require a high degree of manual dexterity.

Employment Outlook

Although the production and use of metal castings are expected to

Coremaker operating machine that produces cores for automobile engine heads.

increase substantially, employment of coremakers is expected to increase only about as fast as the average for all occupations through the mid-1980's, as the growing use of machine coremaking will allow large increases in production with only moderate employment growth. In addition to those job openings created by employment growth, other openings will arise because of the need to replace experienced coremakers who retire, die, or transfer to other occupations. The number of openings may fluctuate greatly from year to year since the demand for foundry products is sensitive to changes in the economy.

Earnings and Working Conditions

In January 1976, average hourly earnings of floor coremakers were $5.30; bench coremakers, $5.28; and machine coremakers, $5.31, according to a wage survey made by the National Foundry Association. By comparison, production workers in all manufacturing industries averaged $5.19 an hour. Coremakers who were paid on an incentive basis generally had higher earnings than those who were paid a straight hourly wage.

Working conditions vary considerably from one foundry to another. Heat, fumes, and dust, have been greatly reduced in many plants by the installation of improved ventilation systems and air-conditioning. Although the injury rate in foundries is higher than the average for manufacturing, coremaking is one of the least hazardous foundry jobs.

For sources of additional information, see the introductory section of this chapter.

MACHINING OCCUPATIONS

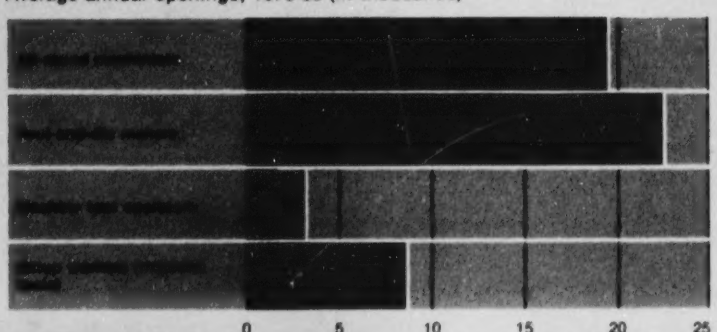
Machine tools are stationary, power-driven devices used to shape or form metal by cutting, impact, pressure, electrical techniques, or a combination of these processes. Most machine tools are named for the way in which they shape metal. For example, commonly used machine tools include boring machines, milling machines, lathes, drilling machines, and grinding machines. In 1976, over 1.1 million machinists, machine tool operators, tool-and-die makers, setup workers, and instrument makers used machine tools to make precise metal parts.

The most outstanding characteristic of machine tools is their precision of operation. For example, in this century the accuracy of machine tools has improved from a thousandth of an inch to about a millionth of an inch. A millionth of an inch is about 1/300th as thick as a human hair. This precision makes possible the production of thousands of identical parts which may easily be interchanged in the assembly or repair of final products. The interchangeability of parts, made possible by machine tools, is the most important requirement for the mass production of goods. As a result, nearly every product of American industry, from cornflakes to turbines, is made either using machine tools or using machines made with machine tools.

All-round machinists can operate most types of machine tools, whereas machine tool operators generally work with one kind only. Tool-and-die makers make dies (metal forms) for presses and diecasting machines, devices to guide drills into metal, and special gauges to determine whether the work meets specified tolerances. Instrument makers use machine tools to produce highly accurate instrument parts from metal and other materials. Setup workers adjust tools for semiskilled machine tool operators to run. (Detailed discussions of work performed, training, and earnings of these occupations are presented in the chapters that follow.)

Technological advances will limit growth in all machining occupations. However, highly skilled machinists and tool-and-die makers will not be affected as much as less skilled operators and setup workers

Selected machining occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

ALL-ROUND MACHINISTS

(D.O.T. 600.280, .281, and .381)

Nature of the Work

All-round machinists are skilled metal workers who can perform a wide variety of machining operations. They are able to set up and operate most types of machine tools used to make metal parts for cars, machines, and other equipment. Machinists also know the working properties of a variety of metals including steel, cast iron, aluminum, brass, and other metals. This knowledge of metals, plus their ability to work with machine tools, enables machinists to turn a block of metal into an intricate part meeting precise specifications.

All-round machinists plan and carry through all the operations needed to make a machined product. They also often are able to switch from making one product to another; as a result, variety is a major feature of all-round machinists' work.

Before they begin actually making a machined product, machinists usually consult blueprints or written specifications for the item. Using these, they are able to select tools and materials for the job and plan the cutting and finishing operations. They also make standard shop computations relating to dimensions of work and machining specifications. To be sure their work is accurate, they check it using precision instruments, such as micrometers, which measure to thousandths or even millionths of an inch. After completing machining operations, they may use hand files and scrapers to smooth rough metal edges before assembling the finished parts with wrenches and screwdrivers.

Like production machinists, all-round machinists who work in plant maintenance shops have a broad knowledge of mechanical principles and machining operations. These workers are responsible for repairing

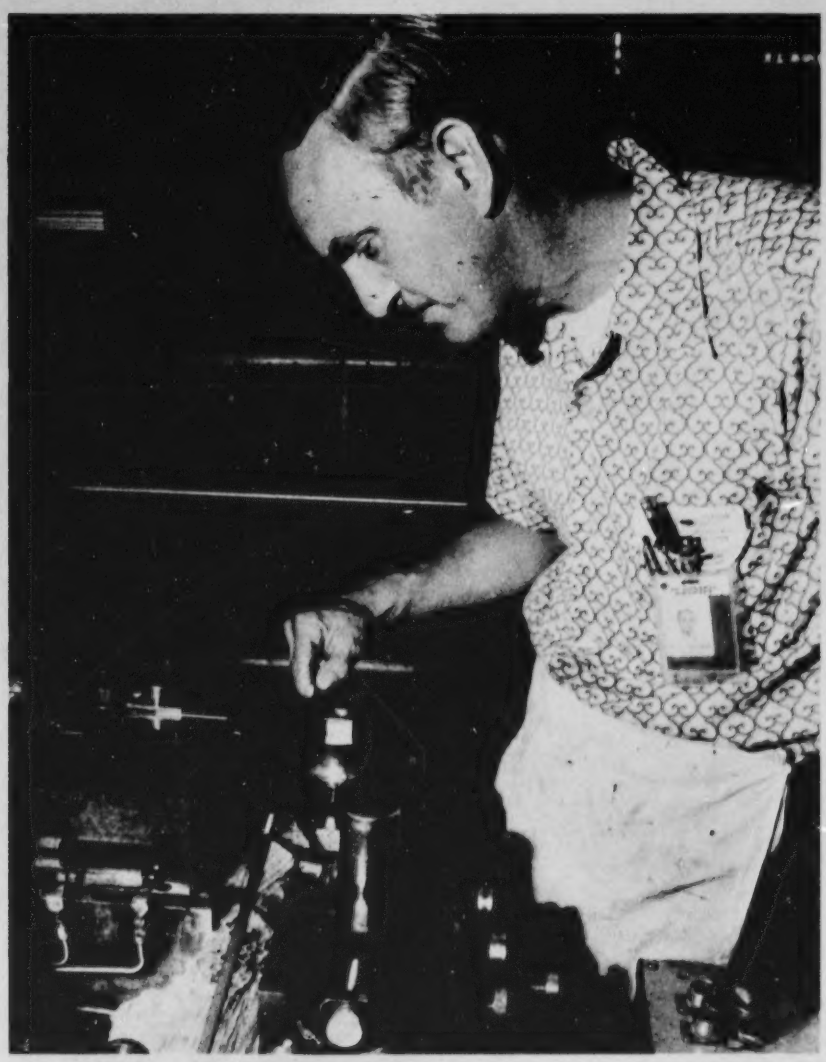
parts or making new parts for machinery that has broken down. They sometimes also adjust and test the parts they have made or repaired for a machine.

Places of Employment

About 400,000 persons worked as machinists in 1976. Almost every factory using substantial amounts of machinery employed all-round machinists to maintain its mechanical equipment. Some all-round machinists made large quantities of identical parts such as automobile axle shafts in production departments of metalworking factories; others made limited numbers of varied products such as missile motor cases in machine shops.

Most all-round machinists worked in the following industries: machinery, including electrical; transportation equipment; fabricated metal products; and primary metals. Other industries employing substantial numbers of these workers were the railroad, chemical, food processing, and textile industries. The Federal Government also employed all-round machinists in Navy yards and other installations.

Although machinists work in all parts of the country, jobs are most plentiful in areas where many factories are located. Among the leading areas of employment are Los Angeles, Chicago, New York, Philadelphia, Boston, San Francisco, and Houston.



Most machinists work in factories that produce metal products such as automobiles and machinery.

Training, Other Qualifications, and Advancement

A 4-year formal apprenticeship is the best way to learn the machinist trade, but some companies have training programs for single-purpose machines that require less than 4 years to complete. Many machinists do learn this trade on the job, however.

Persons interested in becoming machinists should be mechanically inclined and temperamentally suited to do highly accurate work that requires concentration as well as physical effort. Prospective machinists should be able to work independently. Although the work sometimes is tedious and repetitious, all-round machinists frequently have the satisfaction of seeing the final results of their work.

A high school or vocational school education, including mathematics, physics, or machine shop training, is desirable. Some companies require experienced machinists to take additional courses in mathematics and electronics at company expense so that they can service and operate numerically controlled machine tools. In addition, equipment builders generally provide training in the electrical, hydraulic, and mechanical aspects of machine-and-control systems.

Typical machinist apprentice programs consist of approximately 8,000 hours of shop training and about 570 hours of related classroom instruction. In shop training, apprentices learn chipping, filing, hand tapping, dowel fitting, riveting, and the operation of various machine tools. In the classroom, they study blueprint reading, mechanical drawing, shop mathematics, and shop practices.

All-round machinists have numerous opportunities for advancement. Many become supervisors. Some take additional training and become tool-and-die or instrument makers. Skilled machinists may open their own shops or advance into othe

technical jobs in machine programming and tooling.

Employment Outlook

The number of all-round machinists is expected to increase at about the same rate as the average for all occupations through the mid-1980's. Growth in the demand for machined metal parts will cause most of the increase. In addition to openings created by growth in this large occupation, many openings will arise from the need to replace experienced machinists who retire, die, or transfer to other fields of work.

As population and income rise, so will the demand for machined goods, such as automobiles, household appliances, and industrial products. However, technological developments that increase the productivity of machinists are expected to keep employment from rising as fast as the demand for machined goods.

Chief among these technological innovations is the expanding use of numerically controlled machine tools. These machines, which use computers to control various machining operations, significantly reduce the time required to perform machining operations.

Much of the employment growth will occur in the maintenance shops of manufacturing plants as industries continue to use a greater volume of complex machinery and equipment. More skilled maintenance machinists will be needed to prevent costly breakdowns in highly mechanized plants. Often the breakdown of just one machine can stop an entire production line for hours.

Earnings and Working Conditions

The earnings of machinists compare favorably with those of other skilled workers. Machinists employed in metropolitan areas had estimated average hourly earnings of $6.76 in 1976. Average hourly rates in 10 of the areas surveyed, selected to show how wage rates differ in various parts of the country, appear in the accompanying tabulation. Because machinists work indoors, they are able to work year round and in all kinds of weather. As a result, their earnings are relatively stable. Many also receive numerous opportunities for overtime work.

Area	*Hourly rate*
San Francisco—Oakland	$7.82
Detroit	7.61
New York	7.39
Houston	7.23
Chicago	7.19
Minneapolis—St. Paul	6.87
Atlanta	6.65
Dallas—Fort Worth	6.60
Boston	6.33
New Orleans	6.18

Machinists must follow strict safety regulations when working around high-speed machine tools. Short-sleeved shirts, safety glasses, and other protective devices are required to reduce accidents. Most shops are clean and workplaces are well-lighted.

Many machinists are members of unions including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

Sources of Additional Information

The National Machine Tool Builders Association, 7901 Westpark Dr., McLean, Va. 22101—whose members build a large percentage of all machine tools used in this country—will supply, on request, information on career opportunities in the machine tool industry.

The National Tool, Die and Precision Machining Association, 9300 Livingston Rd., Oxon Hill, Md. 20022, offers information on apprenticeship training, including recommended apprenticeship standards for tool and die makers certified by the U.S. Department of Labor's Bureau of Apprenticeship and Training.

The Tool and Die Institute, 777 Busse Highway, Park Ridge, Ill. 60068—a trade association—offers information on apprenticeship training in the Chicago area.

Many local offices of State employment services provide free aptitude testing to persons interested in becoming all-round machinists or tool and diemakers. In addition, the State employment service refers applicants for apprentice programs to employers. In many communities, applications for apprenticeship also are received by labor-management apprenticeship committees.

Apprenticeship information also may be obtained from the following unions (which have local offices in many cities):

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, Skilled Trades Department, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

INSTRUMENT MAKERS (MECHANICAL)

(D.O.T. 600.280)

Nature of the Work

Instrument makers (also called experimental machinists and model-makers) are among the most skilled of all machining workers. They work closely with engineers and scientists to translate designs and ideas into experimental models, special laboratory equipment, and custom instruments. Experimental devices constructed by these craft workers are used, for example, to regulate heat, measure distance, record earthquakes, and control industrial processes. The parts and models may range from simple gears to intricate parts of navigation systems for guided missiles. Instrument makers also modify existing instruments for special purposes.

Instrument makers perform many tasks similair to those done by all-round machinists, tool-and-die makers, and setup workers. For example

they may set up and use machine tools such as lathes and milling machines to fabricate metal parts for the instruments they make. In addition, they use handtools such as files and chisels to smooth rough metal parts. As in other types of machining work, accuracy is important. Like most machining workers, instrument makers measure finished parts to make sure they meet specifications, using a wide variety of precision measuring equipment, including micrometers, verniers, calipers, and dial indicators, as well as standard optical measuring instruments.

Unlike other skilled machining workers, instrument makers often are not given detailed instructions, such as blueprints, for their work. Instead, they may work from rough sketches or verbal instructions, or they may simply be given a concept to work with. As a result, their work often requires considerable imagination and ingenuity. In addition they must often work to finer tolerances than other machining workers. Sometimes specifications must not vary more than 10 millionths of an inch. To meet these standards, they use special equipment or precision devices, such as the electronic height gauge, which other machining workers seldom use. They also work with a wider variety of materials than other machining workers. These materials include plastics and rare metals such as titanium and rhodium.

In some instances, instrument makers work on instruments from start to finish. That is, they make all the parts, assemble them, and then test the finished product. However, in large shops, or where time is important, the work may be divided among a number of workers. Similarly, if an instrument has electrical or electronic components, electronic specialists may be consulted.

Places of Employment

Many of the approximately 6,000 instrument makers employed in 1976 worked for firms that manufactured instruments. Others were in research and development laboratories that make special devices for scientific research. The Federal Government employed many instrument makers.

The main centers of instrument making are located in and around a few large cities, particularly New York, Chicago, Los Angeles, Boston, Philadelphia, Washington, Detroit, Buffalo, and Cleveland.

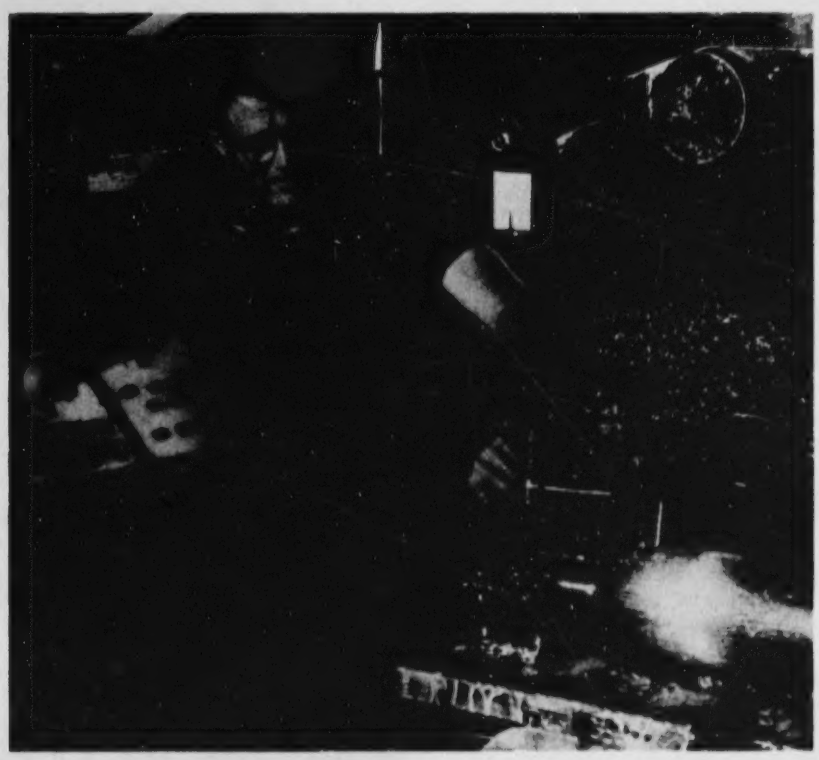
Training, Other Qualifications, and Advancement

Some instrument makers advance from the ranks of machinists or skilled machine tool operators. These already skilled craft workers begin by doing the simpler instrument making tasks under close supervision. Usually 1 to 2 years or more of instrument shop experience are needed to qualify as instrument makers.

Other instrument makers learn their trade through apprenticeships that generally last 4 years. A typical 4-year program includes 8,000 hours of shop training and 576 hours of related classroom instruction. Shop training emphasizes the use of machine tools, handtools, and measuring instruments, and the working properties of various materials. Classroom instruction covers related technical subjects such as mathematics, physics, blueprint reading, chemistry, metallurgy, electronics, and fundamental instrument design. Apprentices must learn enough shop mathematics to plan their work and to use formulas. A basic knowledge of mechanical principles is needed in solving gear and linkage problems.

For apprenticeship programs, employers generally prefer high school graduates who have taken algebra, geometry, trigonometry, science, and machine shopwork. Further technical schooling in electricity, physics, machine design, and electronics often is desirable, and may make possible future promotions to technician jobs.

Persons interested in becoming instrument makers should have a strong interest in mechanical subjects and better than average ability to work with their hands. They must have initiative and resourcefulness



Instrument makers work closely with engineers and scientists.

because instrument makers often work with little or no supervision. Since instrument makers often face new problems, they must be able to develop original solutions. Frequently, they must visualize the relationship between individual parts and the complete instrument, and must understand the principles of the instrument's operation. Because of the nature of their jobs, instrument makers have to be very conscientious and take considerable pride in creative work.

As instrument makers' skills and knowledge improve, they may advance to more responsible positions. For example, they may plan and estimate time and material requirements for the manufacture of instruments or provide specialized support to professional personnel. Others may become supervisors and train less skilled instrument makers.

Employment Outlook

Employment in this very small occupation is expected to increase at about the same rate as the average for all occupations through the mid-1980's. Most openings, however, will occur as workers retire, die, or leave the occupation for other reasons. Overall, replacement needs will be small because there are so few workers in this field.

Some workers will be needed to make models of new instruments for mass production and also to make custom or special instruments, particularly in the expanding field of industrial automation. Also, more versatile and sensitive precision instruments can be expected to emerge from current research and development programs. Laborsaving technological innovations, however, will limit employment growth. Numerically controlled machine tools, for example, reduce the amount of labor required in machining operations.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with those of other highly skilled metalworkers. In 1976, instrument makers generally earned about $7 an hour.

Instrument shops usually are clean and well-lighted, with temperatures strictly controlled. Instrument assembly rooms are sometimes known as "white rooms," because almost sterile conditions are maintained.

Serious work accidents are not common, but machine tools and flying metal particles may cause finger, hand, and eye injuries. Safety rules generally require the wearing of special glasses, aprons, tightly fitted clothes, and short-sleeved shirts.

Many instrument makers are union members. Among the unions representing them are the International Association of Machinists and Aerospace Workers; the International Brotherhood of Electrical Workers; and the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

See the list under this same heading in the previous statement on all-round machinists.

MACHINE TOOL OPERATORS

(D.O.T. 602., 603., 604., 605., and 606.)

Nature of the Work

Machine tool operators use machine tools such as lathes, drill presses, milling machines, grinding machines, and punch presses to shape metal to precise dimensions. Although some operators can work with a wide variety of machine tools, most specialize in one or two types.

Operators fall into two broad skill categories—semiskilled and skilled. Semiskilled operators are essentially machine tenders who perform simple, repetitive operations that can be learned relatively quickly. Skilled operators can perform varied and complex machining operations. Both skilled and semiskilled operators have job titles related to the kind of machine they operate, such as milling machine operator and drill press operator.

Most machine tool operators fall into the semiskilled category. Their jobs vary according to the type of machine they work with; however, there are many tasks common to most machine tools. Typically, semiskilled operators place rough metal stock in a machine tool on which the speeds and operation sequence already have been set by skilled workers. By using special, easy-to-use gauges they watch the machine and make minor adjustments. However, they depend on skilled machining workers for major adjustments when their machine is not working properly.

The work of skilled machine tool operators is similar to that of all-round machinists, except that it usually is limited to only one type of machine and involves little or no hand fitting or assembly work. Skilled machine tool operators plan and set up the correct sequence of machining operations according to blueprints, layouts, or other instructions. They adjust speed, feed, and other controls, and select the proper cutting instruments or tools for each operation. Using micrometers, gauges, and other precision measuring instruments, they compare the completed work with the tolerance limits given in the specifications. They also may select cutting oils to keep the

Machine tool operators must adjust machines with precision.

metal workpiece from getting too hot and lubricating oils to keep the machine tools running smoothly.

Places of Employment

More than 500,000 machine tool operators were employed in 1976. Most worked in factories that produce fabricated metal products, transportation equipment, and machinery in large quantities. Skilled machine tool operators also worked in production departments, maintenance departments, and toolrooms.

Machine tool operators work in every State and in almost every city in the United States. They are concentrated, however, in major industrial areas such as the Great Lakes Region. About one-fourth of all machine tool operators work in the Great Lakes cities of Detroit, Flint, Chicago, Cleveland, and Milwaukee. Among the other areas that have large numbers of these workers are Los Angeles, Philadelphia, St. Louis, and Indianapolis.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. Beginners usually start by simply observing experienced operators at work. Later they learn to use measuring instruments and to make elementary computations needed in shopwork. When trainees first operate a machine, they are supervised closely by more experienced workers. After gaining some experience themselves, beginners often take over more of the duties associated with the tools they operate. For example, they may learn to adjust feed speeds and cutting edges, instead of calling upon other workers to perform these tasks. Some also may learn to read blueprints and plan the sequence of machining work.

Individual ability and effort largely determine the time required to become a machine tool operator. Most semiskilled operators learn their jobs in a few months, but becoming a skilled operator often requires 1 to 2 years. Some companies have formal training programs for new employees.

Although no special education is required for semiskilled jobs, persons seeking such work can improve their opportunities by completing courses in mathematics and blueprint reading. In hiring beginners, employers often look for persons with mechanical aptitude and some experience working with machinery. Physical stamina is important since much time is spent standing. Applicants should be able to work independently. They also should not mind working in a relatively small workspace. Although much of the work is tedious, many machine tool operators derive satisfaction from seeing the results of their work.

Skilled machine tool operators may become all-round machinists, tool-and-die makers, or advance to jobs in machine programming and maintenance.

Employment Outlook

Job opportunities for machine tool operators should be fairly plentiful in the years ahead. Employment in the occupation is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to openings arising from growth, many thousands of openings are expected to occur each year in this large occupation as operators retire, die, or transfer to other fields of work.

More machine tool operators will be needed as metalworking industries expand their output. However, the use of faster and more versatile automatic machine tools and numerically controlled machine tools will result in greater output per worker and tend to limit employment growth. Other factors that may slow growth in this occupation are the increasingly important new processes in metalworking, such as electrical discharge and ultrasonic machining, and the use of powdered metals that reduce the machining necessary for a final product.

Workers with thorough backgrounds in machining operations, mathematics, blueprint reading, and a good working knowledge of the properties of metals will be better able to adjust to the changing job requirements that will result from technological advances.

Earnings and Working Conditions

Machine tool operators are paid according to hourly or incentive rates, or on the basis of a combination of both methods. Highly skilled operators in metropolitan areas had estimated hourly earnings of $7.11 in 1976. This compares favorably with the average for nonsupervisory workers in private industry, except farming. Average hourly rates in 10 of the areas surveyed, selected to show how wage rates of machine tool operators differ in various parts of the country, appear in the accompanying tabulation.

Area	*Hourly rate*
Detroit	$7.89
Cleveland	7.30
Chicago	7.14
St. Louis	6.93
Baltimore	6.84
Cincinnati	6.34
Houston	6.30
Minneapolis—St. Paul	6.18
Dallas—Fort Worth	6.12
Boston	5.76

Most shops are clean and workplaces are well-lighted. Machine tool operators must use protective glasses to protect their eyes from flying metal particles. They cannot wear loose-fitting garments as these might get caught in the machine, injuring the operator or causing damage to the machine.

Most machine tool operators belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; and the United Steelworkers of America.

Sources of Additional Information

See the list under this same head-

ing in the statement on all-round machinists elsewhere in the *Handbook*.

SETUP WORKERS (MACHINE TOOLS)

(D.O.T. 600.380)

Nature of the Work

Machine tools used in shops that do machining in large volume usually are both very large and very complex. Setup workers, often called machine tool job setters, are skilled workers who specialize in preparing these tools for use. Most setup workers work on only one type of machine, such as a drill press or lathe; however, some set up several different kinds.

Before they begin preparing a machine for use, setup workers consult blueprints, written specifications, or job layouts. From these they can determine how fast the material to be machined should be fed into the machine, operating speeds, tooling, and the order in which the machine will perform its operations (operation sequence). They then select and install the proper cutting or other tools and adjust guides, stops, and other controls.

After setting up the machine, they usually make a trial run to be sure that it is running smoothly and producing parts that conform to specifications. When they are sure the machine is functioning properly, they explain to semiskilled operators how to run the machine and how to be sure that the machine's output meets specifications. They then turn the machine over to the semiskilled operators to begin production.

Setup worker in a turret lathe operation.

Places of Employment

In 1976, an estimated 60,000 setup workers were employed in factories that manufactured fabricated metal products, transportation equipment, and machinery. Most worked for large companies that employed many semiskilled machine tool operators. Setup workers usually are not employed in maintenance shops or in small jobbing shops.

Setup workers are found in every State. However, employment is concentrated in major industrial areas such as Los Angeles, Philadelphia, New York, Chicago, Detroit, and Cleveland.

Training, Other Qualifications, and Advancement

Setup workers must meet the same qualifications as all-round machinists. They must be able to operate one or more kinds of machine tools and select the sequence of operations so that metal parts will be made according to specifications. The ability to communicate clearly is important in explaining the machining operations to semiskilled workers. Setup workers may advance within a shop to supervisory jobs or transfer into other jobs, such as parts programmer.

Employment Outlook

Employment of setup workers is expected to increase about as fast as

the average for all occupations through the mid-1980's. Although consumer and industrial demand for machined goods will grow, partly offsetting this will be greater productivity of setup workers due to the increasing use of numerically controlled machined tools. In these machine tools, cutting sequences, feed speeds, tool selection, and other operations are controlled by a computer. Most job opportunities will arise from the need to replace experienced workers who retire, die, or transfer to other occupations.

Earnings and Working Conditions

The earnings of setup workers compare favorably with those of other skilled machining workers. In 1976, setup workers in metropolitan areas had average earnings of about $7 an hour.

Because they work with high-speed machine tools that have sharp cutting edges, setup workers must follow certain safety practices. For example, they cannot wear loose-fitting clothes as these might get caught in the machine and they must wear safety goggles to protect their eyes from flying metal particles.

Many setup workers are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implemen Workers of America; and the United Steelworkers of America.

Sources of Additional Information

See the list under this same heading in the statement on all-round machinists elsewhere in the *Handbook*.

TOOL-AND-DIE MAKERS

(D.O.T. 601.280, .281, and .381)

Nature of the Work

Tool-and-die makers are highly skilled, creative workers whose products—tools, dies, and special guiding and holding devices—are used by other machining workers to mass-produce metal parts. Toolmakers produce jigs and fixtures (devices that hold metal while it is shaved, stamped, or drilled). They also make gauges and other measuring devices used in manufacturing precision metal parts. Diemakers construct metal forms (dies) to shape metal in stamping and forging operations. They also make metal molds for diecasting and for molding plastics. Tool-and-die makers also repair worn or damaged dies, gauges, jigs, and fixtures, and design tools and dies.

Compared with most other machining workers, tool-and-die makers have a broader knowledge of machining operations, mathematics, and blueprint reading. Like machinists, tool-and-die makers use almost every type of machine tool and precision measuring instrument. Because they work with all the metals and alloys commonly used in manufacturing, tool-and-die makers must be familiar with the machining properties, such as heat tolerance, of a wide variety of metals and alloys.

Places of Employment

More than 180,000 tool-and-die makers were employed in 1976. Most worked in plants that produce manufacturing, construction, and farm machinery. Others worked in automobile, aircraft, and other transportation equipment industries; small

Tool-and-die makers must have a broad knowledge of machine operations.

tool-and-die shops; and electrical machinery and fabricated metal industries.

Although tool-and-die makers are situated throughout the country, jobs are most plentiful in areas where many large factories are located. About one-fifth of all tool-and-die makers work in the Detroit and Flint, Chicago, and Los Angeles areas, which are major manufacturing centers for automobiles, machinery, and aircraft, respectively. Among the other areas that have large numbers of these workers are Cleveland, New York, Newark, Dayton, and Buffalo.

Training, Other Qualifications, and Advancement

Tool-and-die makers obtain their skills in a variety of ways including formal apprenticeship, vocational school, and on-the-job training. Formal apprenticeship programs, however, are probably the best way to learn the trade.

In selecting apprentices, most employers prefer persons with a high school or trade school education. Applicants should have a good working knowledge of mathematics and physics, as well as considerable mechanical ability, finger dexterity, and an aptitude for precise work. Some employers test apprentice applicants to determine their mechanical aptitudes and their abilities in mathematics.

Most of the 4 years of a tool-and-die apprenticeship are spent in practical shop training. Apprentices learn to operate the drill press, milling machine, lathe, grinder, and other machine tools. They also learn to use handtools in fitting and assembling tools, gauges, and other mechanical equipment, and study heat treating and other metalworking processes. Classroom training consists of shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading. Several years of experience after apprenticeship are often necessary to qualify for more difficult tool-and-die work. Some companies have separate apprenticeship programs for toolmaking and diemaking.

Some machining workers become tool-and-die makers without completing formal apprenticeships. After years of experience as skilled machine tool operators or machinists, plus additional classroom training, they develop into skilled all-round workers who can make tools and dies.

Skilled tool-and-die makers have numerous paths for advancement. Some advance to supervisory and administrative positons in industry. Many tool-and-die makers become tool designers and others may open their own tool-and-die shops.

Employment Outlook

Employment of tool-and-die makers is expected to increase at about the same rate as the average for all occupations through the mid-1980's. Most openings, however, will occur as experienced tool-and-die makers retire, die, or transfer to other fields of work.

The long-range expansion in metalworking industries will result in a continued need for tools and dies. The growth of this occupation may be limited, however, by the use of electrical discharge machines and numerically controlled machines that have significantly changed toolmaking processes. Numerically controlled machining operations require fewer of the special tools and jigs and fixtures, and could increase the output of each tool-and-die maker.

The extensive skills and knowledge of tool-and-die makers can be acquired only after many years of experience. Because of this, tool-and-die makers are able to change jobs within the machining occupations more easily than other less skilled workers.

Earnings and Working Conditions

Tool-and-die makers are among the highest paid machining workers. In 1976, tool-and-die makers employed in metropolitan areas had estimated earnings of $7.21 an hour. This was about one and one-half times as much as the average for all nonsupervisory workers in private industry, except farming. Average hourly rates in 13 of the areas surveyed, selected to show how wage rates for tool-and-die makers differ in various parts of the country, appear in the accompanying tabulation.

Area	*Hourly rate*
San Francisco—Oakland	$8.87
Detroit	7.88
Chicago	7.72
Baltimore	7.61
Cleveland	7.18
Atlanta	7.07
Dallas—Fort Worth	7.00
Cincinnati	6.82
Boston	6.62
Houston	6.61
New York	6.45
Salt Lake City	6.17
Chattanooga	5.56

As with other machining workers, tool-and-die makers wear protective glasses when working around metal-cutting machines. Tool-and-die shops are usually safer than similar operations in production plants.

Many tool-and-die makers are members of unions, including the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the United Steelworkers of America.

Sources of Additional Information

See the list under this same heading in the statement on all-round machinists elsewhere in the *Handbook*.

PRINTING OCCUPATIONS

In 1976, about 390,0000 printing craft workers were employed to produce newspapers, magazines, business forms, and hundreds of other printed materials. Although most worked for publishers and commercial printing shops, many had jobs in insurance companies, paper mills, government agencies, and many other organizations that do their own printing.

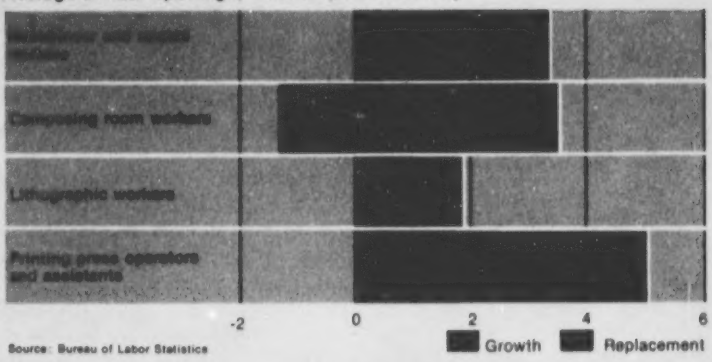
Printing craft workers usually specialize in one area of printing operations: Type composition, platemaking, presswork, or binding. The most common way to learn the skills needed in most of these fields is through apprenticeship, which generally lasts from 4 to 6 years. Apprenticeship applicants usually must be high school graduates who are at least 18 years of age, but requirements vary among employers. Most printing craft workers who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35- to 37-1/2-hour range.

Through the mid-1980's, opportunities to enter printing crafts will stem mainly from the need to replace experienced workers who retire, die, or leave the field for other reasons. Employment growth also will provide job openings in some crafts, but laborsaving technological developments will restrict growth in others.

The statements that follow deal with employment opportunities for the major groups of printing workers: Composing room occupations, photoengravers, electrotypers and stereotypers, printing press operators and assistants, lithographers, and bookbinders.

Most job openings in the printing occupations are to replace persons who retire or leave their jobs for other reasons

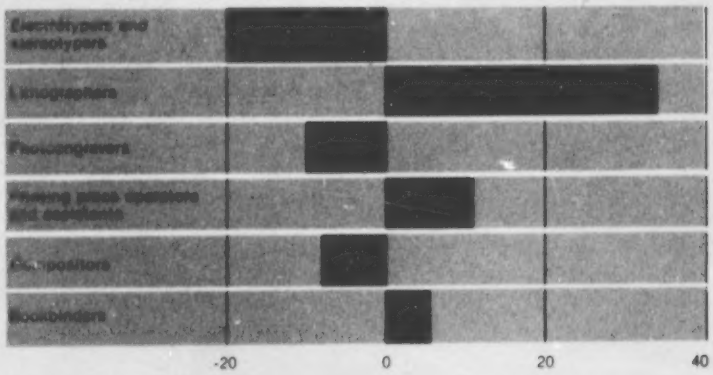
Selected printing occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

There will be fewer jobs in some printing occupations in 1985 than in 1976, due to improved technology

Percent change in employment, 1976-85



Source: Bureau of Labor Statistics

COMPOSITORS

(D.O.T. 650.582, 654.782, and 973.381)

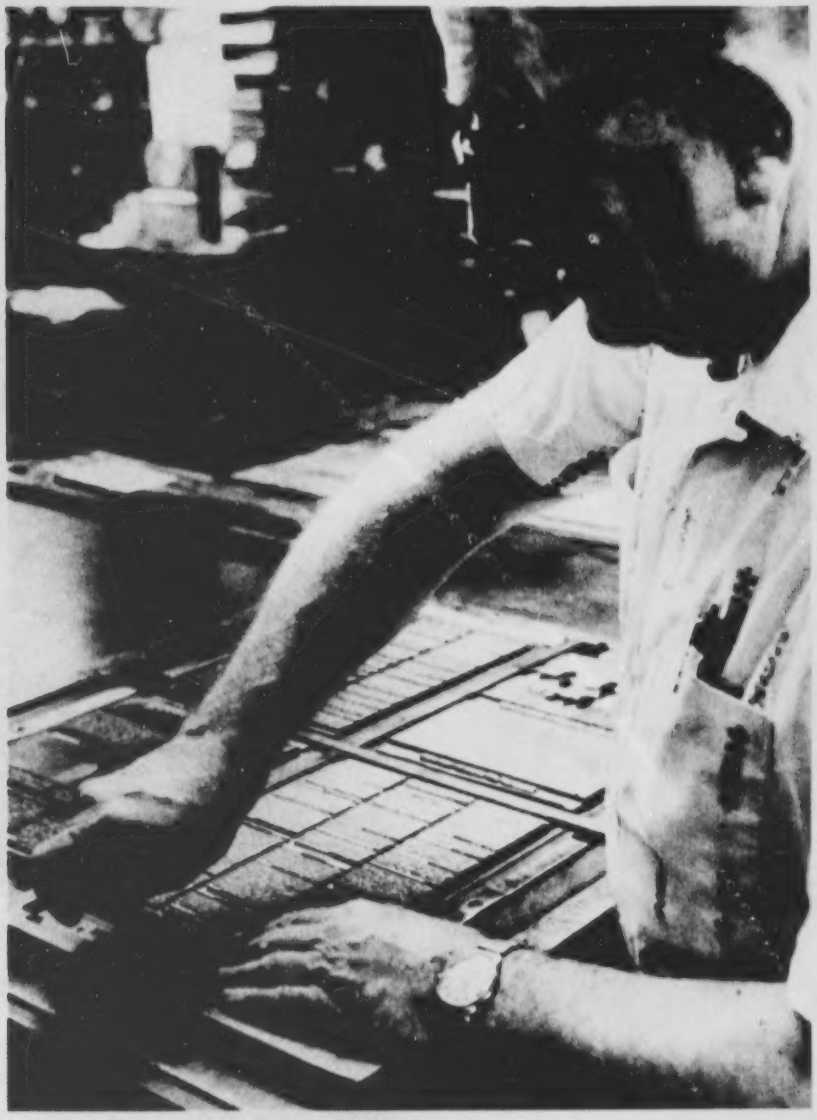
Nature of the Work

In a small shop, one person may do all the worked needed to complete a printing job. In large shops however, the work is divided among specialists. Editors select the material to be printed, while composing room workers prepare preliminary printing plates for press room workers who do the actual printing. Compositors, the most numerous of the composing room occupations, are vital to insur-

ing that the job is completed accurately and on time.

After deciding what is to be printed and how it should look, editors send the material or "copy" along with a list of specifications to the composing room. There, a composing room supervisor reviews the editor's specifications and marks the manuscript with instructions about the style and size of type, column width, and size of pictures or illustrations. The copy—the term given to the material to be printed—then is given to a compositor who specializes in typesetting.

Hand compositors (D.O.T. 973.381) make up the oldest composing room occupation. Today, hand typesetting only is used for small jobs in which the setting of type by machine is impractical. Hand typesetters read from the copy and set each line of type, letter by letter, on a "compositing stick," a device that holds type in place. They select the place where words will be divided and a hyphen placed if the word doesn't fit on a line (hyphenation), as well as adjust the spacing of the type with pieces of metal so that the line of type will be the width of the column. As each "stick" is filled, they slide the completed lines into a shallow metal tray called "galley."



A compositor apprenticeship generally covers a 6-year period.

Linotype and monotype machine operators are craft workers who operate semiautomatic machines that set type much more rapidly than hand methods.

Linotype machine operators (D.O.T. 650.582) read from copy clipped to the machine and operate a keyboard to select letters and other characters. As they press the keys, metal molds of the letters are assembled into lines of words. After completing a line, operators touch a lever and the machine automatically fills the molds with lead, forming a line of type into a solid metal strip called a "slug." The slugs are assembled into the type frames from which printing plates are made.

Monotype keyboard operators (D.O.T. 650.582) also operate a keyboard machine. However, instead of selecting metal molds, the monotype machine produces a perforated paper tape. *monotype keyboard operators* or *monotype caster operators* (D.O.T. 650.782) feed the tape into a machine that reads the tape and automatically select metal molds for each letter. The machine then forces molten metal into each mold to form the type.

While machines make their tasks easier, monotype and linotype machine operators must hyphenate and adjust type spacing to fit the width of columns. In small plants, operators also may maintain and repair typesetting machines.

Some typesetting will continue to be done by hand or with monotype and linotype machines. However, more and more firms are using phototypesetting machines, which can set type much more rapidly than linotype or monotype machines. With this equipment, a photographic process replaces the casting of type and the final product is a photographic film of the type rather than a metal slug.

In a common type of phototypesetting, a *phototypesetter* (D.O.T. 650.582) types in the text without

regard to column width or hyphenation and produces a magnetic or perforated paper tape. The operator then feeds the tape containing the text into a computer that is programmed to do hyphenation and create columns of text. The computer creates a second tape—containing the text as it will appear when printed—that phototypesetters insert into a photocomposition machine. This machine displays the individual characters on the tape and photographs them. The phototypesetter then develops films of the material to be printed.

The most advanced method of typesetting uses electronic phototypesetting equipment. With this equipment, an operator uses a keyboard to select the size and style of type to select column width and provide spacing instructions, as well as to store each character in a computer. The computer then displays columns of type on a screen that is similar to a TV picture tube. Operators visually check the text and make any required corrections. They then photograph the screen to obtain a film of the material. These machines can prepare entire pages of type and any accompanying pictures instead of a single line of type.

After the copy is set, typesetters pass it to other compositors who arrange the columns of type, pictures, and illustrations according to the desired layout for each page. If 3etter press printing equipment are being used, they assemble the metal type and photoengravings in a large metal frame that clamps all the pieces together. If lithographic film equipment is being used, they cut the film of type and pictures and tape the pieces in place. Either method results in a preliminary printing plate.

After arranging all the pages of a particular job in proper sequence, compositors use a proof press to make a test of the entire job. Page proofs are checked with the original copy for errors and returned to the editor for final changes. After final changes have been put into the type, the plate is sent to the pressroom where production printing plates are made.

Places of Employment

About 152,000 workers were employed in composing room occupations in 1976. About one-third work for newspaper plants. Many others work for commercial printing plants, book and magazine printers, and Federal, State, and local governments. Some work for banks, insurance companies, advertising agencies, manufacturers, and other firms that do their own printing.

Composing room workers are located in almost every community throughout the country, but they are concentrated in large cities.

Training and Other Qualifications

Individuals who want to be all-round skilled compositors usually learn their skills through apprenticeship programs.

Generally, apprenticeship covers a 6-year period of progressively advanced training, supplemented by classroom instruction or correspondence courses. However, this period may be shortened by as much as 2 to 2-1/2 years for apprentices who have had previous experience or schooling or who show the ability to learn the trade more rapidly.

After basic training as a hand compositor, the apprentice receives intensive training in one specialized field or more, such as in the operation of typesetting machines, including phototypesetting machines, as well as in specialized work in hand composition and photocomposition.

Applicants for apprenticeship generally must be high school graduates and in good physical condition. They usually are given aptitude tests. Important qualifications include training in mathematics and English, especially spelling. Printing and typing courses in vocational or high schools are good preparation for apprenticeship applicants, and a general background in electronics and photography is becoming increasingly useful. Artistic ability is an asset for a compositor in layout work. Many technical institutes, junior colleges, and colleges offer courses in printing technology, which provide a valuable background for people who are interested in becoming all-round compositors.

More and more compositors are bypassing the traditional apprentice approach and learning the work through on-the-job experience. Persons with good typing skills can learn to be phototypesetting machine operators in a relatively short period of time. These workers need not be trained as skilled compositors but they must be familiar with printing terms and measurements.

Employment Outlook

Employment in composing room occupations is expected to decline through the mid-1980's. Nevertheless, a few thousand job openings are expected each year as experienced workers retire, die, or change occupations.

In spite of the anticipated expansion in the volume of printing, employment in composing room occupations is expected to decline because of the trend to high-speed phototypesetting and typesetting computers. These high speed machines require fewer operators than the traditional hot metal method of typesetting.

For the jobs that do become available, opportunities should be best for persons who have completed post high school programs in printing technology, such as those offered by technical institutes and junior colleges. Many employers prefer to hire applicants who have tompleted these programs because the comprehensive training that they receive helps them learn composing room trades and adapt to new processes and techniques more rapidly.

Although most job opportunities will continue to be in the printing industry, a growing number will be found in other industries, such as paper and textile mills, which are doing their own typesetting instead of contracting it to printing firms.

Earnings and Working Conditions

Union compositors on the day shift in newspaper plants had an estimated average minimum rate of $7.91 an hour in 1976, according to a survey

of 69 large cities. This rate was about one-half more than the average for nonsupervisory workers in all private industries, except farming.

Working conditions for compositors vary from plant to plant. Some heat and noise are made by typesetting machines. In general, the new plants are well-lighted and clean, and many are air-conditioned. Hand compositors have to stand for long periods and do some heavy lifting. People with some types of physical handicaps, such as deafness, have been able to work in the trade.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops, the local office of the International Typographical Union, or the local office of the State employment service.

For general information 6n composing room occupations, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Typographic Composition Association, Inc., 2233 Wisconsin Ave. NW., Washington, D.C. 20007.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22209.

LITHOGRAPHERS

Nature of the Work

Lithography, also called offset printing, is one of the most rapidly growing methods of printing. It is a process of photographing the matter to be printed, making a printing plate from the photograph, and pressing the inked plate against a rubber plate which in turn presses it onto the paper.

Lithographers are responsible for a variety of printing activities ranging from photographing copy and pictures to making the final printing plates. Most lithographers are divided into specialized occupations such as camera operators, artists, strippers, and platemakers.

Camera operators (D.O.T. 972.382) start the process of making a lithographic plate by photographing and developing negatives of the material to be printed. They generally are classified as line camera operators, halftone operators, or color separation photographers. Negatives may need retouching to lighten or darken certain parts. *Lithographic artists* (D.O.T. 972.281) make these corrections by sharpening or reshaping images on the negatives. They do the work by hand, using chemicals, dyes, and special tools. Like camera operators, they are assigned to only one phase of the work, and may have job titles such as dot etchers, retouchers, or letterers.

Strippers (D.O.T. 971.281) arrange and paste the negatives onto layout sheets, which are used by platemakers to make press plates. Platemakers (D.O.T. 972.781) cover the surface of flat pieces of metal with a coating of photosensitive chemicals, or may use plates with the coating already applied. They then put the layout sheet on top of the plate and expose both to bright lights. As the final step, platemakers treat the plate with chemicals to bring out the images of the material to be printed. When a large number of plates or a multiple number of images are needed, operators use a photocomposition machine.

Many technical institutes, junior colleges, and colleges offer 2-year programs in printing technology.

Places of Employment

About 29,000 skilled lithographers were employed in 1976. Many work for commercial printing plants, newspapers, and book and magazine printers. Some work for the U.S. Government Printing Office.

Although lithographic workers are located in all parts of the country, most are employed in large cities.

Training and Other Qualifications

A 4- or 5-year apprenticeship program usually is required in order to become a well-rounded lithographic craft worker. These programs may emphasize a specific craft, such as camera operator or lithographic artist, although an attempt is made to make the apprentice familiar with all lithographic operations.

Usually, apprenticeship applicants must be in good physical condition, high school graduates, and at least 18 years of age. Aptitude tests usually are given to prospective apprentices to determine if they are suited for the work.

Many technical institutes, junior colleges, and colleges offer 2-year programs in printing technology, which provide a valuable background for persons who are interested in learning lithographic crafts. High school and vocational school training in printing, photography, mathematics, chemistry, physics, and art also are helpful.

Employment Outlook

Employment of lithographers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the job openings resulting from employment growth, the need to replace workers who retire, die, or change occupations will provide some openings.

Employment of lithographic workers is expected to increase in response to the continued growth of offset printing. Commercial printing firms and newspaper publishers in-

creasingly are using offset printing methods instead of letterpresses. Employment growth also will be stimulated by the greater use of photographs and drawings in printed matter, and by the more widespread use of color in many printed products.

Employment opportunities should be best for people who have completed post-high school programs in printing technology, such as those offered by technical institutes and junior colleges. Many employers prefer to hire applicants who have completed these programs because the comprehensive training they receive helps them learn lithography and adapt more rapidly to new processes and techniques.

Earnings and Working Conditions

Based on a survey of union wages in 69 large cities, it is estimated that in 1976, average minimum wages for lithographic artists were $8.98; for strippers $8.67; for camera operators $8.78; and platemakers $8.78. These rates were higher than the average for all nonsupervisory workers in private industry, except farming.

Lithographic workers are on their feet much of the time, but the work is not strenuous. They sometimes are under pressure to meet publication deadlines.

Many lithographic workers are members of the Graphic Arts International Union.

Sources of Additional Information

Details on apprenticeship and other training opportunities in lithographic occupations are available from local employers such as newspapers and printing shops, local offices of the Graphic Arts International Union, or the local office of the State employment service. For information on schools that offer courses in printing technology, write to:

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

For general information on lithographic occupations, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 105 West Adams St., Suite 905, Chicago Ill. 60603.

Graphic Arts International Union, 1900 L St. NW., Washington, D.C. 20036.

International Printing and Graphic Communications Union, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22201.

PHOTOENGRAVERS

(D.O.T. 971.281 and .382)

Nature of the Work

Photoengravers make metal printing plates of pictures and other copy that cannot be set up in type. In letterpress photoengraving, ink is rolled over a printed surface which stands higher than the rest of the plate. When paper is pressed against the raised surface, the print or image is picked up. Similarly, gravure photoengravers make gravure cylinders on which the image is etched below the surface of the cylinder. Ink is placed in the etched or sunken areas, and when paper is pressed against the surface the ink is lifted out and appears on the paper. In both methods, however, the work of photoengravers is the same.

For a typical job, photoengravers first mount the picture or copy to be reproduced on a board, adjust the position and focus of a camera, and take a picture. After developing the negative, they print its image on a flat, metal plate by coating the plate with a chemical solution sensitive to light, placing the negative on the plate, and exposing both to a bright light. As the final step in making the printing plate, photoengravers put the plate in an acid bath which eats the metal away from areas which will not be covered with ink. The areas to receive ink—those that were shielded from the light by the negative—stand out to make contact with the paper.

Most photoengravers learn their trade through a 5-year apprenticeship program.

The number of photoengraving operations performed depends on the quality of the printing required. Photoengravings for very high quality books or periodicals, for example, require more careful finishing than those for newspapers. Photoengravers use handtools to inspect and touch up the plates. They cut away metal from the nonprinting part of the plate to prevent it from touching the inking rollers during printing.

In a small shop, the entire photoengraving operation usually is done by one person. In large shops, however, the work is divided among specialists who perform a particular operation such as camera work, printing, or etching.

Places of Employment

An estimated 10,000 skilled photoengravers were employed in 1976. More than half work in commercial shops that make photoengravings for other printing firms. Newspapers and photogravure shops employ several thousand photoengravers. Book and magazine printers and the Federal Government also employ these workers. Many photoengravers have their own shops.

Although photoengravers are located in all parts of the country, em-

ployment is concentrated in large printing centers, such as New York, Chicago, Philadelphia, and Los Angeles.

Training and Other Qualifications

Most photoengravers learn their trade through a 5-year apprenticeship program that includes at least 800 hours of classroom instruction. In addition to the care and use of tools, the apprentice is taught to cut and square negatives, inspect negatives for defects, mix chemicals, sensitize metals, and operate machines used in the photoengraving process.

Apprenticeship applicants must be at least 18 years of age and generally must have a high school or vocational school education or its equivalent, preferably with courses in printing, chemistry, and physics. Many employers require a physical examination for prospective photoengravers. Good eyesight is particularly important because of the close work and color discrimination involved.

Employment Outlook

Employment opportunities for photoengravers are expected to be scarce in the years ahead. Despite the growing use of photographs and other illustrations in publications, employment of photoengravers will decline as many firms switch from letterpress to offset printing, which requires no photoengraving. Also, new technological advances such as color scanners and color enlargers plus the trend toward automated platemaking should reduce the need for these workers. However, some job openings are expected each year as experienced photoengravers retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

It is estimated that photoengravers on the day shift in newspaper plants earned an average minimum rate of $8.47 an hour in 1976, based on a union survey of 69 large cities. This average was about two-thirds more than the average for all nonsupervisory workers in private industry, except farming.

Photoengravers stand up much of the time, but the work is not strenuous. Work areas usually are air-conditioned and well-lighted. Most photoengravers are members of the Graphic Arts International Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers such as newspapers and printing shops, the local office of the union mentioned above, or the local office of the State employment service.

For general information on photoengravers, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 105 West Adams St., Suite 950, Chicago, Ill. 60603.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

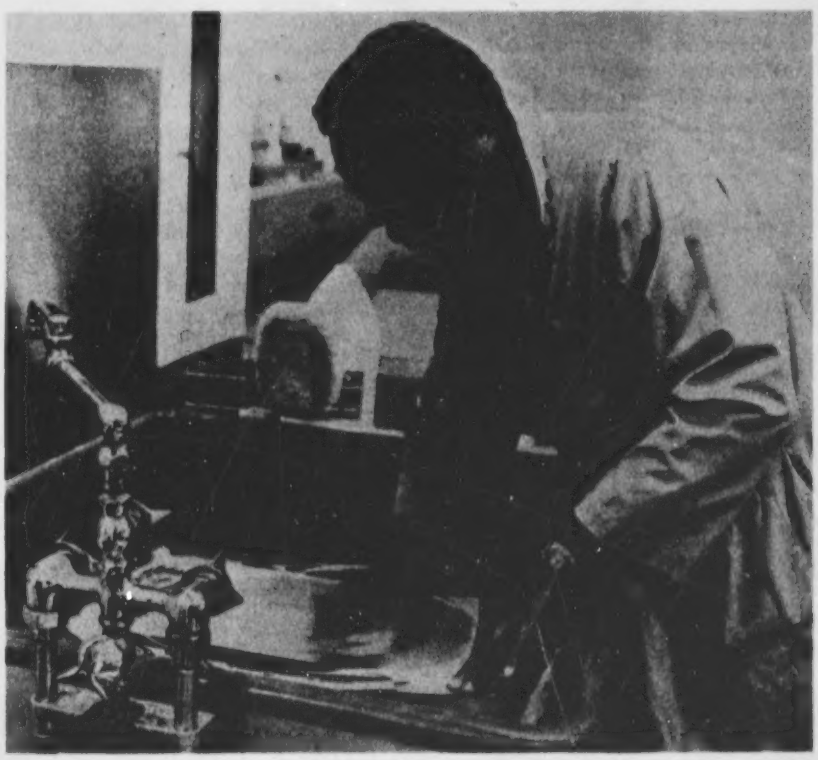
Graphic Arts International Union, 1900 L St. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22201.

ELECTROTYPERS AND STEREOTYPERS

Nature of the Work

Electrotypers (D.O.T. 974.381) and *stereotypers* (D.O.T. 975.782) make duplicate press plates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly for newspapers. Electrotyping and stereotyping are necessary because most volume printing requires the use of duplicate plates. When a large edition of a



Stereotyper prepares mats for casting machines.

magazine or newspaper is printed, several plates must be used to replace those that become too worn to make clear impressions. Also, by having duplicate plates, printers can use several presses at the same time and finish a big run quickly. Furthermore, many big plants use rotary presses, which require curved plates made by either electrotyping or stereotyping from flat type forms.

Electrotypers make a wax or plastic mold of the metal type form. They then coat the mold with chemicals and place the mold into an electrolytic bath that puts a metallic shell on the coated mold. Electrotypers then strip the shell from the mold and fill the back of the shell with molten lead to form a plate. After removing excess metal from the edges and back of the plate, electrotypers inspect the plate for any defects.

The stereotyping process is simpler, quicker, and less expensive than electrotyping, but it does not yield as durable or as fine a plate. Stereotypers make molds or mats of papier-mache' instead of wax or plastic. The mat is placed on the type form and covered with a cork blanket and a sheet of fiberboard. The covered form is run under heavy steel rollers to impress the type and photoengravings on the mat. Then the mat is placed in a stereotype casting machine which casts a composition lead plate on the mold. In many of the larger plants, automatic machines cast stereotype plates.

Some electrotypers and stereotypers do only one phase of the work, such as casting, molding, or finishing. Others handle many tasks.

Places of Employment

About 4,000 electrotypers and stereotypers were employed in 1976. Many electrotypers work in large plants that print books and magazines. Most stereotypers work for newspaper plants, but some work in large commercial printing plants. Electrotypers and stereotypers also are employed in service shops that do this work for printing firms.

Jobs in these trades can be found throughout the country, but employment is concentrated in large cities.

Training and Other Qualifications

Nearly all electrotypers and stereotypers learn their trades through 5- to 6-year apprenticeships. Electrotyping and stereotyping are separate crafts and relatively few transfers take place between the two. The apprenticeship program of each trade covers all phases of the work and almost always includes classes in related technical subjects as well as training on the job.

Apprenticeship applicants must be at least 18 years of age and, in most instances be able to pass physical examinations that usually are given to prospective apprentices. Due to the decline in demand for electrotypers and stereotypers, however, very few apprenticeships have been offered in the last several years. Many experienced electroplaters and stereotypers are now being retrained as plate makers in offset and press operators.

Employment Outlook

Job opportunities for electrotypers and stereotypers are expected to be scarce through the mid-1980's. Despite the anticipated increase in the volume of printing, employment of electrotypers and stereotypers is expected to decline because of labor-saving developments. For example, automatic plate casting eliminates many steps in platemaking. The use of plastic printing plates also requires less labor because such plates are more durable and reduce the demand for duplicate plates. Furthermore, the greater use of offset printing reduces the need for electrotype and stereotype plates, which are not needed in offset printing.

Earnings and Working Conditions

Based on a union wage survey, it is estimated that in 1976, union minimum wage rates in 69 large cities averaged $7.23 an hour for electrotypers and $7.88 an hour for stereotypers in book and commercial printing shops. Both averages were considerably higher than the average for all nonsupervisory workers in private industry, except farming.

Much of the work in these trades requires little physical effort since the preparation of duplicate printing plates is highly mechanized. However, some lifting of relatively heavy press plates occasionally is required.

Nearly all electrotypers and stereotypers are members of the International Printing and Graphic Communications Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers, such as newspapers and printing shops, the local office of the International Printing and Graphic Communications Union, or the local office of the State employment service.

For general information on electrotypers and stereotypers, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Printing and Graphic Communications Union, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22209.

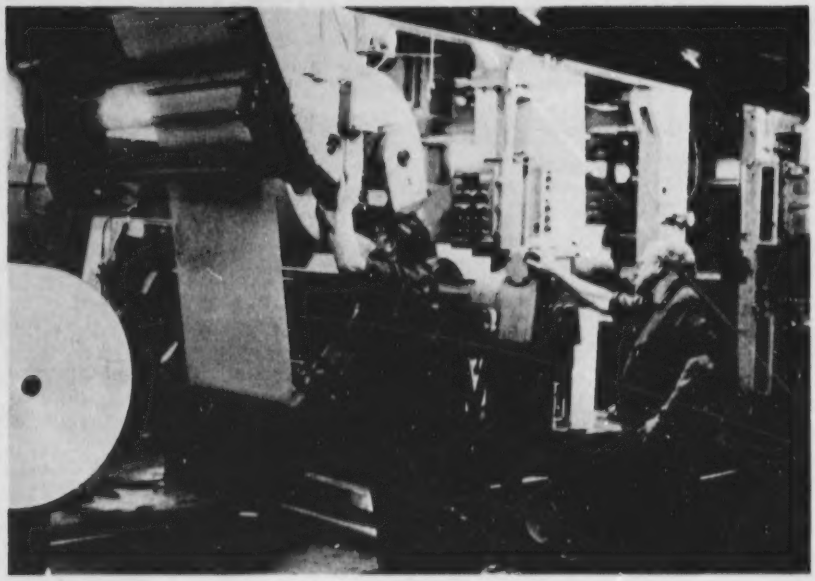
PRINTING PRESS OPERATORS AND ASSISTANTS

(D.O.T. 651.782, .885, and .886)

Nature of the Work

Printing operations are performed in a pressroom. Printing press operators prepare and operate the printing presses.

Before actually starting the press, press operators set up and adjust the press to insure that the printing impressions are distinct and uniform. Press operators first insert and lock type setups or plates into the press bed and then tighten the locking attachment with a wrench. The press operator then levels the press plates by placing pieces of paper that are



Press operator adjusts controls.

exactly the right thickness underneath low areas of the plates.

Press operators also adjust control margins and the flow of ink to the inking roller. In some shops, they oil and clean the presses and make minor repairs. Press operators who work with large presses have assistants and helpers.

Press operators' jobs may differ from one shop to another, mainly because of differences in the kinds and sizes of presses. Press operators in small commercial shops generally operate relatively simple manual presses. On the other hand, a crew of several press operators and press assistants runs giant presses used by the large newspaper, magazine, and book printers. These presses are fed paper zn big rolls called "webs" up to 50 inches or more in width. 0t ey print the paper on both sides; cut, assemble, and fold the pages; and count the finished newspaper sections as they come off the press.

Most press operators are generally designated according to the type of press they operate: letterpress, gravure, or offset.

Places of Employment

About 145,000 press operators and assistants were employed in 1976. More than half work for commercial printing shops and book and magazine publishers. Many others have jobs in newspaper plants. Some press operators and assistants work for banks, insurance companies, manufacturers, and other organizations that do their own printing, such as Federal, State, and local goverments.

Press operators and assistants can find jobs throughout the country, but employment is concentrated in large cities.

Training and Other Qualifications

Most press operators learn their trade through apprenticeship, but some workers learn as helpers or press assistants. Others obtain their skills through a combination of work experience and vocational or technical school training.

The length of apprenticeship and the content of training depend largely on the kind of press used in the plant. The apprenticeship period in commercial shops is 2 years for press assistants, and 4 to 5 years for press operators. In addition to on-the-job instruction, the apprenticeship includes related classroom or correspondence school courses. Courses in printing provide a good background. Because of technical developments in the printing industry, courses in chemistry and physics also are helpful. Mechanical aptitude is important in making press adjustments and repairs. An ability to visualize color is essential for work on color presses. Physical strength and endurance are needed for work on some kinds of presses, where operators lift heavy plates and stand for long periods.

Technological changes have had a tremendous effect on the skill requirements of press operators. For example, printing companies which change from sheet-fed offset presses to web-offset presses have to retrain their entire press crew because the skill requirements for the two types of press are very different. Web-offset presses, with their faster operating speeds, require faster decisions monitoring of more variables, and greater physical effort.

Advancement opportunities generally are limited. Press operators may advance in pay and responsibility by taking a job working on a more complex printing press or by becoming a supervisor.

Employment Outlook

Employment of press operators is expected to increase more slowly than the average for all occupations through the mid-1980's. Despite the increased use of faster and more efficient presses, more press operators will be needed because of the growth in the amount of printed materials.

In addition to the jobs from employment growth, a few thousand openings will arise each year as experienced workers retire, die, or leave their job for other reasons. However, printing press operators are expected to face competition for jobs. Since there are generally long waiting lists for apprenticeship programs, most people will have to take jobs as press assistants or unskilled laborers before being selected for an apprenticeship. It is not uncommon for a person to work 2 or 3 years or more before beginning apprenticeship training.

Since many firms are switching to web offset presses from letterpresses or sheet-fed presses, opportunities

are expected to be more favorable for web-press operators.

Although most job opportunities will continue to be in the printing industry, a growing number of openings will be found in other industries, such as papermills, which are doing more of their own presswork instead of contracting it out to printing firms.

Earnings and Working Conditions

Based on a survey of union wages in 69 large cities, it is estimated that in 1976 the average minimum hourly rate for newspaper press operators-in-charge was $8.18; for newspaper press operators, $7.65; for book and job cylinder press operators, $7.72; and for book and job press assistants and feeders, $6.84. These rates were higher than the average for all nonsupervisory workers in private industy, except farming. Many press operators work night shifts and receive extra pay.

Pressrooms are noisy, and workers in certain areas frequently wear ear protectors. Press operators are subject to hazards when working near machinery. At times, they work under pressure to meet deadlines.

Many pressroom workers are covered by union agreements. The principal union in this field is the International Printing and Graphic Communications Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local employers such as newspapers and printing shops, the local office of the union mentioned above, or the local office of the State employment service.

For general information about press operators and assistants, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts International Union, 1900 L St. NW., Washington, D.C. 20036.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

International Printing and Graphic Communications Union, 1730 Rhode Island Ave. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22209.

BOOKBINDERS AND BINDERY WORKERS

Nature of the Work

Many printed items, such as books and magazines, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled *bookbinders* (D.O.T. 977.781).

Edition-binding—making books in quantity from big, flat printed sheets of paper—is the most complicated kind of binding. Bookbinders first fold the printed sheets into units, known as "signatures," so that the pages will be in the right order. They then insert any illustrations that have been printed separately, gather and assemble signatures in proper order, and sew them together. They shape the book bodies with presses and trimming machines and reinforce them with glued fabric strips. Covers are glued or pasted onto the book bodies, and then the books undergo a variety of finishing operations and frequently are wrapped in paper jackets. Machines are used extensively throughout the process.

Many bindery workers are trained in only one operation.

Bookbinders seldom perform all the different binding tasks, but many have had training in all of them. In large shops, bookbinders may be assigned to one or a few operations, most often to the operation of complicated machines, such as a large paper cutter or a folding machine.

In many binding shops much of the work is done by bindery workers who are trained zn only one operation 6r in a small number of relatively simple tasks. For example, bindery workers perform such tasks as wastening sheets or signatures together using a machine stapler and feeding signatures into various machines for stitching, folding, or gluing operations.

Some bookbinders work in hand binderies designing original bindings and special bindings for a small number of copies of a large edition or restoring and rebinding rare books. This skilled work requires creative ability, knowledge of materials, and a thorough background in the history of binding. Hand bookbinding is perhaps the only kind of binding that gives the individual an opportunity to work at a variety of jobs.

Places of Employment

About 80,000 bookbinders and bindery workers were employed in 1976. Many work in shops that specialize in bookbinding; others work in the bindery departments of book publishing firms, commercial printing plants, and large libraries. Some bookbinders work for the Federal Government.

Although bookbinders work in all parts of the country, employment is concentrated in large printing centers such as New York, Chicago, Washington, D.C., and Los Angeles.

Training, Other Qualifications, and Advancement

A 4- or 5-year apprenticeship, which includes on-the-job training as well as related classroom instruction, generally is required to qualify as a skilled bookbinder. Apprenticeship applicants usually must have a high school education, mechanical apti-

tude, and be at least 18 years of age. During the apprenticeship, trainees learn to assemble signatures; to renovate old, worn bindings; and to use various binding machines, such as punchers and folders.

Most bindery workers learn their tasks through informal on-the-job training that may last from several months to 2 years. A large number, however, learn through formal apprenticeship programs that include classroom instruction as well as on-the-job training.

High school students interested in bookbinding careers should take shop courses to develop their mechanical skills.

Advancement opportunities generally are limited. In large binderies skilled bookbinders with considerable experience may advance to supervisors.

Employment Outlook

Employment of bookbinders and bindery workers is expected to increase more slowly than the average for all occupations through the mid-1980's. Most job openings will arise as experienced workers retire, die, or change occupations.

Despite the anticipated growth in the amount of bound printed materials, employment growth will be limited by the increasing mechanization of bindery operations. For example, the use of integral folders that automatically fold pages as they come off the press eliminates the need for bindery workers to do the folding by hand.

Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average for other printing crafts. Based on a survey of union wage rates in 69 large cities, it is estimated that mininimum wage rates for bookbinders in publishing firms and bookbinding shops averaged about $7.47 an hour in 1976. This rate was about one and one-half times the average for all nonsupervisory workers in private industry, except farming.

Wage rates for bindery workers are considerably lower than the rates for bookbinders, and are among the lowest for printing industry workers. A survey of union wages in 69 large cities shows that in 1976 the average minimum hourly rate for bindery workers was $4.77.

Accuracy, patience, neatness, and good eyesight are among qualities needed by bookbinders. Good finger dexterity is essential for those who count, insert, paste, and fold.

Bookbinding shops tend to be noisy when machinery is operating. Bookbinders have some variety in their jobs, but the jobs of bindery workers tend to be monotonous. Long periods of standing and constant use of the arms can be tiring.

Many bindery workers are members of The Graphic Arts International Union.

Sources of Additional Information

Details about apprenticeship and other training opportunities may be obtained from local bookbinding shops, local offices of the Graphic Arts Union, or the local office of the State employment service.

For general information on bookbinding occupations, write to:

American Newspaper Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Graphic Arts International Union, 1900 L St. NW., Washington, D.C. 20036.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22201.

OTHER INDUSTRIAL PRODUCTION AND RELATED OCCUPATIONS

ASSEMBLERS

Nature of the Work

When Henry Ford began producing his automobile on an assembly line, modern mass production was born. Workers who before had built each automobile independently, now found themselves specializing in just one part of the job. Production became a team effort, with each worker performing a single task on every car rolling by on the line. Over the years, the assembly line spread to other industries, until today almost every manufactured item is produced in this way.

The workers who put together the parts of manufactured articles are called assemblers. Sometimes hundreds are needed to turn out a single finished product.

Many assemblers work on items that automatically move past their work stations on conveyors. In the automobile industry, for example, one assembler may start nuts on bolts by hand or with a hand tool, and the next worker down the line may tighten the nuts with a power wrench. These workers must complete their job within the time it takes the part or product to pass their work station.

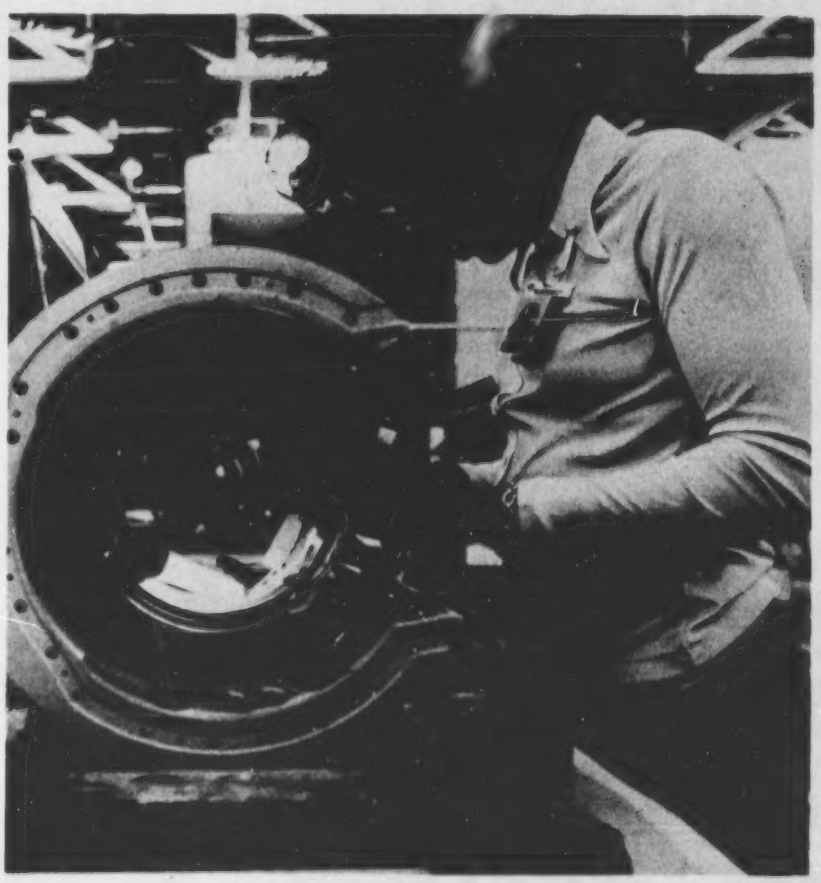
Other assemblers, known as bench assemblers, do more delicate work. Some make subassemblies. These units are the intermediate steps in the production process; for example, steering columns for automobiles or motors for vacuum cleaners. Others make entire products. Assemblers in rifle manufacturing plants build complete rifles from a collection of parts and subassemblies and then test all the moving parts to be sure they function correctly. Bench work generally requires the ability to do precise and detailed work. Some electronics assemblers, for example, use tweezers, tiny cutters, and magnifying lenses to put together the small components used in radios and calculators.

Another group of assemblers, called floor assemblers, put together large machinery or heavy equipment on shop floors. School buses, cranes, and tanks are put together in this manner. Parts are installed and fastened, usually with bolts, screws, or rivets. Assemblers often use a power tool, such as a soldering iron or power drill, to get a proper fit.

A small number of assemblers are skilled workers who work with little or no supervision on the more complex parts of subassemblies, and are responsible for the final assembly of complicated jobs. A skilled assembler may have to wire the tubes for a television set or put together and test a calculator. Some work with the engineers and technicians in the factory, assembling products that these people have just designed. To test new ideas and build models, these workers must know how to read blueprints and other engineering specifications, and use a variety of tools and precision measuring instruments.

Places of Employment

About 1,100,000 assemblers worked in manufacturing plants in 1976. Almost two-thirds were in plants that made machinery and motor vehicles. More than half of all



Skilled assemblers work on complex subassemblies.

assemblers were employed in the heavily industrialized States of California, New York, Michigan, Illinois, Ohio, and Pennsylvania.

Training, Other Qualifications, and Advancement

Inexperienced people can be trained to do assembly work in a few days or weeks. New workers may have their job duties explained to them by the supervisor and then be placed under the direction of experienced employees. When new workers have developed sufficient speed and skill, they are placed "on their own" and are responsible for the work they do.

Employers seek workers who can do routine work at a fast pace. A high school diploma usually is not required.

For some types of assembly jobs, applicants may have to meet special requirements. Some employers look for applicants with mechanical aptitude and prefer those who have taken vocational school courses such as machine shop. Good eyesight, with or without glasses, may be required for assemblers who work with small parts. In plants that make electrical and electronic products, which may contain many different colored wires, applicants often are tested for color blindness. Floor assemblers may have to lift and fit heavy objects, thus they should be physically fit.

As assemblers become more experienced they may progress to assembly jobs that require more skill and be given more responsibility. A few advance to skilled assembly jobs. Experienced assemblers who have learned many assembly operations and thus understand the construction of a product may become product repairers. These workers fix assembled articles that inspectors have ruled defective. Assemblers also may advance to inspector and a few are promoted to supervisor. Some assemblers become trainees in skilled trades jobs such as machinist.

Employment Outlook

Employment of assemblers is expected to grow faster than the average for all occupations through the mid-1980's, with thousands of openings each year. Most job openings, however, will result as workers retire, die, or leave the occupation.

More assemblers will be needed in manufacturing plants to produce goods for the Nations's growing economy. As population grows and personal income rises, the demand for consumer products, such as automobiles and household appliances, will increase. At the same time, business expansion will increase the demand for industrial machinery and equipment.

Most assemblers work in plants that produce durable goods, such as automobiles and aircraft, which are particularly sensitive to changes in business conditions and national defense needs. Therefore, even though employment is expected to grow, jobseekers may find opportunities scarce in some years.

Earnings and Working Conditions

Wage rates for assemblers ranged from about $3 to $7 an hour in 1976, according to information from a limited number of union contracts. Most assemblers covered by these contracts made between $4 and $6 an hour. Some assemblers are paid incentive or piecework rates, and therefore can earn more by working more rapidly.

The working conditions of assemblers differ, depending on the particular job performed. Bench assemblers who put together electronic equipment may work in a room that is clean, well lighted, and free from dust. Floor assemblers of industrial machinery may come in contact with oil and grease, and their working areas may be quite noisy from nearby machinery or tools that are used. Workers on assembly lines may be under pressure to keep up with the speed of the lines. Since most assemblers only perform a few steps in the assembly operation, assembly jobs tend to be more monotonous than other blue-collar jobs.

Work schedules of assemblers may vary at plants with more than one shift. Usually in order of seniority, workers can accept or reject a certain job on a given shift.

Many assemblers are members of labor unions. These include the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; the International Union; United Automobile, Aerospace and Agricultural Implement Workers of America; the International Brotherhood of Electrical Workers; and United Steelworkers.

Source of Additional Information

Additional information about employment opportunities for assemblers may be available from local offices of the State employment service.

AUTOMOBILE PAINTERS

(D.O.T. 845.781)

Nature of the Work

Automobile painters make old and damaged motor vehicles "look like new." These skilled workers repaint older vehicles that have lost the luster of their original paint and make fender and body repairs almost invisible. (Painters who work on the production lines at motor vehicle manufacturing plants are discussed elsewhere in the *Handbook*.)

To prepare an automobile for painting, painters or their helpers remove the original paint or rust using air-or electric-powered sanders and a course grade of sandpaper. Before painting, they also must remove or protect areas which they do not want painted, such as chrome trim, headlights, windows, and mirrors. Painters or their helpers cover these areas with paper and masking tape.

When the car is ready, painters use a spray gun to apply primer coats to the automobile surface. After each coat of primer dries, they sand the surface until it is smooth before applying another coat. Final sanding may be uone by hand, using a fine grade of sandpaper. If the surface to be painted is not smooth, the paint job will be rough and uneven. Small nicks and scratches that cannot be removed by sanding are filled with automobile body putty.

Before painting repaired portions of an automobile, painters often have

to mix paints to match the color of the car. This important part of the job can be very difficult when painting repaired parts of older cars because the original color often fades over the years.

Before applying paint, painters adjust the nozzle of the spray gun according to the kind of lacquer or enamel being used and, if necessary, they adjust the air-pressure regulator to obtain the correct pressure. If the spray gun is not adjusted properly, the paint may run or go on too thinly. To speed drying, they may place the freshly painted automobile under heat lamps or in a special infrared oven that is sealed to prevent dust and bugs from getting onto the fresh paint. After the paint has dried, painters or their helpers usually polish the newly painted surface.

Places of Employment

About 30,000 persons worked as automobile painters in 1976. Almost two-thirds worked in shops that specialize in automobile repairs. Most others worked for automobile and truck dealers. Some painters worked for organizations that maintained and repaired their own fleets of motor vehicles, such as trucking companies and buslines.

Painters are employed throughout the county, but are concentrated in metropolitan areas.

Training, Other Qualifications, and Advancement

Most automobile painters start as helpers and gain their skills informally by working with experienced painters. Beginning helpers usually perform tasks such as removing automobile trim, cleaning and sanding surfaces to be painted, and polishing the finished work. As helpers gain experience, they progress to more complicated tasks, such as mixing paint to achieve a good match and using spray guns to apply primer coats and painting small areas. Becoming skilled in all aspects of automobile painting usually requires 3 to 4 years of on-the-job training.

A small number of automobile painters learn through apprenticeship. Apprenticeship programs, which generally last 3 years, consist of on-the-job training supplemented by classroom instruction in areas such as shop safety practices, proper use of equipment, and general painting theory.

Automobile painters often acquire their skills by working with experienced painters.

Persons considering this work as a career should have good health, keen eyesight, and a good color sense. Courses in automobile-body repair offered by high schools and vocational schools provide h[illegible]ful experience. Completion of hi[illegible]hool generally is not a requirement but may be an advantage, because to many employers high school graduation indicates that the person has at least some of the traits of a good worker, such as reliability and perseverance.

An experienced automobile painter with supervisory ability may advance to shop supervisor. Many experienced painters with the necessary funds open their own shops.

Employment Outlook

Employment of automobile painters is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs created by growth, several hundred openings are expected to arise each year because of the need to replace experienced painters who retire or die. Openings also will occur as some painters transfer to other occupations.

Employment of automobile paintvrs is expected to increase primarily because more 4otor vehicles will be damaged in traffic accidents. As the number of vehicles on the road grows, accident losses will grow, even though better highways, lower speed limits, driver training courses, and improved bumpers and other safety features on new vehicles may slow the rate of growth.

Most persons who enter the occupation can expect steady work because the automobile repair business is not affected much by changes in economic conditions.

Job opportunities will be best in heavily populated areas. Many shops in small cities do not have enough business to hire trainees.

Earnings and Working Conditions

Painters employed by automobile dealers in 36 large cities had estimated average hourly earnings of $8.50 in 1976, compared to an average of $4.87 for all nonsupervisory workers in private industry, except farming. Skilled painters usually earn between

two and three times as much as inexperienced helpers and trainees.

Many painters employed by automobile dealers and independent repair shops receive a commission based on the labor cost charged to the customer. Under this method, earnings depend largely on the amount of work a painter does and how fast it is completed. Employers frequently guarantee their commissioned painters a minimum weekly salary. Helpers and trainees usually receive an hourly rate until they become sufficiently skilled to work on a commission basis. Trucking companies, buslines, and other organizations that repair their own vehicles usually pay by the hour. Most painters work 40 to 48 hours a week.

Automobile painters are exposed to fumes from paint and paint-mixing ingredients. In most shops, however, the painting is done in special ventilated booths that protect the painters. Painters also wear masks to protect their noses and mouths. Painters must be agile because they often bend and stoop while working to reach all parts of the car.

Many automobile painters belong to unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most painters who are union members work for the larger automobile dealers, trucking companies, and buslines.

Sources of Additional Information

For more details about work opportunities, contact local employers, such as automobile-body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about apprenticeship and other programs that provide training opportunities.

For general information about the work of automobile painters, write:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils, Inc., 188 Industrial Dr., Suite 112, Elmhurst, Ill. 60126.

BLACKSMITHS

(D.O.T. 356.381 and 610.381)

Nature of the Work

Years ago the village blacksmith was as vital to a community as the country doctor. No one else could repair a broken wagon wheel, shoe a horse, or forge a tool to suit a farmer's needs. Today, the blacksmith's work still is important in factories and mines where heavy metal equipment must be repaired, and at stables and racetracks. Power hammers and ready-made horseshoes have made much of the work easier, but the basic tasks remain largely the same.

The first thing a blacksmith must do when making or repairing anything made of metal is to heat it in a forge to soften it. Once the metal begins to glow red, it is ready for the blacksmith to pick it up with tongs, place it on the anvil, and begin to shape it using presses and power hammers. On repair jobs broken parts are rejoined by hammering them together. The blacksmith uses handtools such as hammers and chisels to finish the task at hand, often reheating the metal in the forge to keep it soft and workable.

Before a metal article can be used, it must be hardened. To complete this stage of the process, the blacksmith reheats the metal to a high temperature in the forge and then plunges it into a water or oil bath. However, metal hardened in this way is brittle and can break under stress. If strength is important, blacksmiths temper the metal instead. To do this, they heat the metal to a lower temperature than they use for hardening, keep it hot for some time, and then allow it to cool at room temperature.

Blacksmiths who specialize in shoeing horses are called farriers. Today, most farriers use ready-made horseshoes so that their primary job is to adjust shoes for a proper fit. On some occasions, however, they may have to make the shoes themselves. Racehorses need special care because they must withstand strenuous punishment to their legs and hooves. Improper shoeing can permanently damage a valuable horse. Farriers who shoe racehorses need to be able to recognize weaknesses in a horse's legs, and shoe it accordingly. Some horses, for example, need shoes that are thicker on the outside as compared to the inside edge in order to walk correctly. To shoe a horse, farriers begin by removing the old shoe with nail snippers and pincers. They examine the horse's hoof for bruises and then clean, trim, and shape the hoof. When the hoof is ready, they position and nail a shoe onto the hoof and finish by trimming the hoof flush to the new shoe.

Industrial occupations that are similar to blacksmith include forge and hammer operator, welder, and boilermaker. (These occupations are discussed elsewhere in the *Handbook*.)

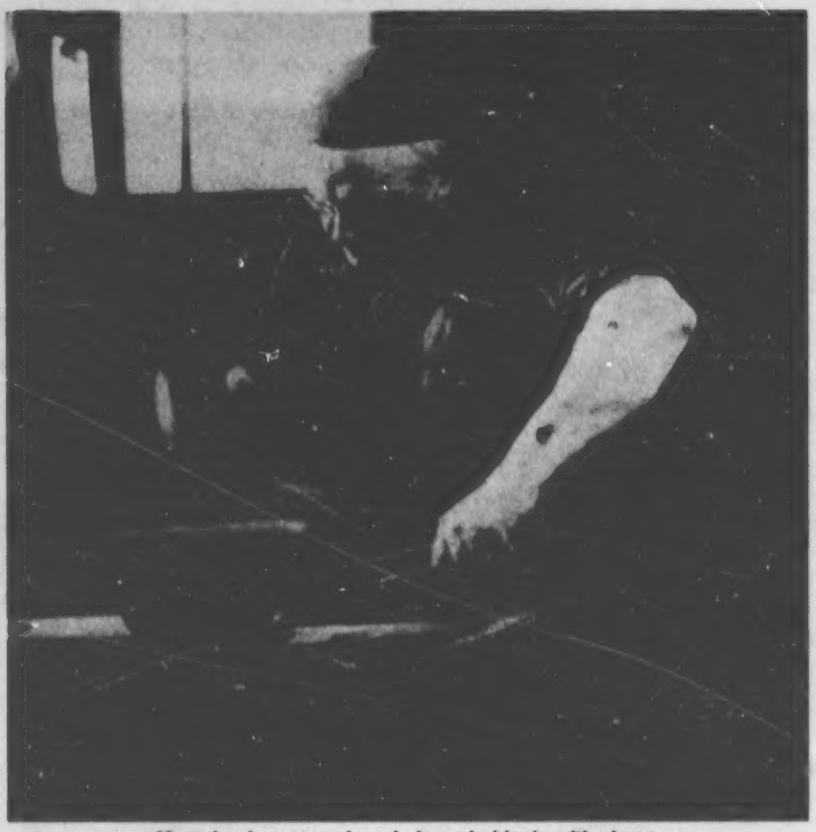
Places of Employment

Of the approximately 10,000 blacksmiths employed in 1976, almost two-thirds worked in factories, railroads, and mines. The remainder worked in small shops, and most were self-employed. Blacksmiths work in all parts of the country—in rural communities as well as in large industrial centers.

Most farriers are self-employed and contract their services to horse trainers at racetrack stables and to owners of horses used for private or public recreation.

Training, Other Qualifications, and Advancement

Many beginners enter the occupation by working as helpers in blacksmith shops or large industrial firms that employ blacksmiths. Others enter through formal apprenticeship programs and transfer from related occupations such as forge operator or hammer operator. Apprenticeship programs usually last 3 or 4 years. The programs teach blueprint reading, proper use of tools and equipment, heat-treatment of metal,



Many beginners work as helpers in blacksmith shops.

and forging methods. Most apprentices are found in large industrial firms rather than in small repair shops. Vocational school or high school courses in metalworking and blueprint reading are helpful to persons interested in becoming blacksmiths.

Many farriers learn their craft by assisting experienced farriers. Others may take a short course in horseshoeing lasting about 3 or 4 weeks before gaining experience on their own or as farriers' assistants. Courses in horseshoeing are taught in several colleges, as well as at private horseshoeing schools. Most of these are located in the Midwest. Persons considering enrolling at any school should talk to a farrier in their area concerning the school's performance in producing qualified farriers. At least 3 to 5 years of special training or experience are needed to obtain the skills necessary to shoe racehorses.

Farriers who wish to work at racetracks must pass a licensing examination. During the examination, they must demonstrate their knowledge of corrective shoeing techniques and the proper shoe to use depending on the condition of the horse's hoof or leg, and the condition of the racetrack. The examination is a performance test and does not require a written examination.

Blacksmiths must be in good physical condition. Pounding metal and handling heavy tools and parts require considerable strength and stamina. Farriers, of course, must have the patience to handle horses.

Opportunities for advancement are limited, especially for blacksmiths who work in small repair shops. However, blacksmiths may advance to be supervisors or inspectors in factories, or decide to open their own repair shops. Blacksmiths also may be able to transfer to related occupations such as forge, hammer, and press operators.

Farriers may open their own shops or travel from job to job with a portable forge, if one is needed. Those with sufficient skills to pass a licensing examination may find employment at racetracks.

Employment Outlook

Employment of blacksmiths is expected to decline through the mid-1980's. Forge shops are using machines to produce many of the metal articles that were formerly handmade by blacksmiths. In addition, welders are doing much of the metal repair work once done by blacksmiths. Nevertheless, some job openings will occur as experienced blacksmiths retire, die, or leave the occupation for other reasons.

Employment of farriers may increase slightly due to the growing popularity of horseracing and the increasing use of horses for recreational purposes. Since this is a small occupation, however, relatively few job openings will become available.

Earnings and Working Conditions

In union contracts covering a number of blacksmiths in steel plants and in the shipbuilding and petroleum industries, hourly pay ranged from $4 to $7.50 in 1976. Earnings of blacksmiths in railroad shops averaged $6.87 an hour in 1976. According to limited information, yearly earnings of farriers who shoed saddle horses averaged between $10,000 and $12,000 a year in 1976; those who shoed racehorses averaged around $15,000 a year.

Blacksmith shops tend to be hot and noisy, but conditions have improved in recent years because of large ventilating fans and less vibration from new machines. Blacksmiths are subject to burns from forges and heated metals and cuts and bruises from handling tools. Safety glasses, metal-tip shoes, face shields, and other protective devices have helped to reduce injuries.

The jobs of some farriers may be seasonal. During the summer months, when horses are ridden more often, farriers may work long hours and even on weekends. Also, those who specialize in shoeing racehorses often work at several different racetracks within their area and, therefore, must travel a great deal. In areas where horseracing is season-

al, they may have to move to another State during the off season.

Many blacksmiths are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other unions representing blacksmiths include the United Steelworkers of America, the Industrial Union of Marine and Shipbuilding Workers of America, and the International Union of Journeymen Horseshoers.

Sources of Additional Information

For details about training opportunities in this trade, contact local blacksmith shops and local offices of the State employment service.

BLUE-COLLAR WORKER SUPERVISORS

Nature of the Work

In any organization, someone has to be boss. For the millions of workers who assemble television sets, service automobiles, lay bricks, unload ships, or perform any of thousands of other activities, a blue-collar worker supervisor is the boss. These supervisors direct the activities of other employees and frequently are responsible for seeing that millions of dollars worth of equipment and materials are used properly and efficiently. While blue-collar worker supervisors are most commonly known as foremen or forewomen, they also have many other titles. In the textile industry they are referred to as second hands; on ships they are known as boatswains; and in the construction industry they are often called overseers, straw bosses, or gang leaders.

Although titles may differ, the job of all blue-collar worker supervisors is similar. They tell other employees what jobs are to be done and make sure the jobs are done correctly. For example, loading supervisors at truck terminals assign workers to load trucks, and then check that the material is loaded correctly and that each truck is fully used. They may mark freight bills and keep charts to record the loads and weight of each truck. In some cases, supervisors also do the same work as other employees. This is especially true in the construction industry where, for example, bricklayer supervisors also lay brick.

Because they are responsible for the output of other workers, supervisors make work schedules and keep production and employee records. They use considerable judgment in planning and must allow for unforeseen problems such as absent workers and machine breakdowns. Teaching employees safe work habits and enforcing safety rules and regulations are other supervisory responsibilities. They also may demonstrate timesaving or laborsaving techniques to workers and train new employees.

In addition to their other duties, blue-collar worker supervisors tell their subordinates about company plans and policies; reward good workers by making recommendations for wage increases, awards, or promotions; and deal with poor workers by issuing warnings or recommending that they be fired or laid off without pay for a day or more. In companies where employees belong to labor unions, supervisors may meet with union representatives to discuss work problems and grievances. They must know the provisions of labor-management contracts and run their operations according to these agreements.

Places of Employment

About 1,445,000 blue-collar worker supervisors were employed in 1976. Although they work for almost all businesses and government agencies, over half work in manufacturing, supervising the production of cars, washing machines, or any of thousands of other products. Most of the rest work in the construction industry, in wholesale and retail trade, and in public utilities. Because employment is distributed in much the same way as population, jobs are located in all cities and towns.

Training, Other Qualifications, and Advancement

When choosing supervisors, employers generally look for experience, skill, and leadership qualities. Employers place special emphasis on the ability to motivate employees, maintain high morale, command respect, and get along with people. Completion of high school often is the minimum educational requirement, and 1 or 2 years of college or technical school can be very helpful to workers who want to become supervisors.

Coordinating assignments is a responsibility of the blue-collar worker supervisor.

Most supervisors rise through the ranks—that is, they are promoted from jobs where they operated a machine, or worked on an assembly line, or at a construction craft. This work experience gives them the advantage of knowing how jobs should be done and what problems may arise. It also provides them with insight into management policies and employee attitudes towards these policies. Supervisors are sometimes former union representatives who are familiar with grievance procedures and union contracts. To supplement this work experience, larger companies usually have training programs to help supervisors make management decisions. Smaller companies often use independent training organizations or written training materials.

Although few blue-collar worker supervisors are college graduates, a growing number of employers are hiring trainees with a college or technical school background. This practice is most prevalent in industries with highly technical production processes, such as the chemical, oil, and electronics industries. Employers generally prefer backgrounds in business administration, industrial relations, mathematics, engineering, or science. The trainees undergo on-the-job training until they are able to accept supervisory responsibilities.

Supervisors with outstanding ability, particularly those with college education, may move up to higher management positions. In manufacturing, for example, they may advance to jobs such as department head and plant manager. Some supervisors, particularly in the construction industry, use the experience and skills they gain to go into business for themselves.

Employment Outlook

Employment of blue-collar worker supervisors is expected to increase at about the same rate as the average for all occupations through the mid-1980's. In addition, many job openings will arise as experienced supervisors retire, die, or transfer to other occupations.

Population growth and rising incomes will stimulate demand for goods such as houses, air conditioners, TV sets, and cars. As a result, more blue-collar workers will be needed to produce and sell these items, and more supervisors will be needed to direct their activities. Although most of these supervisors will continue to work in manufacturing, a large part of the increase in jobs will be due to the expansion of nonmanufacturing industries, especially in the trade and service sectors.

There is usually keen competition for supervisory jobs. Competent workers who possess leadership ability and have a few years of collge are the most likely to be selected.

Earnings and Working Conditions

In 1976, average annual earnings of blue-collar worker supervisors who worked full time were $15,149, compared with $12,946 for workers in all occupations. Supervisors usually are salaried. Their salaries generally are determined by the wage rates of the highest paid workers they supervise. For example, some companies keep wages of supervisors about 10 to 30 percent higher than those of their subordinates. Some supervisors may receive overtime pay.

Since supervisors are responsible for the work of other employees, they generally work more than 40 hours a week and are expected to be on the job before other workers arrive and after they leave. They sometimes do paperwork at home, such as making work schedules or checking employee time cards, and may find themselves worrying about job-related problems after work.

Working conditions vary from industry to industry. In factories, supervisors may get dirty around machinery and materials and have to put up with noisy factory operations.

Some supervisors who have limited authority may feel isolated, neither a member of the work force nor an important part of management. On the other hand, supervisors have more challenging and prestigious jobs than most blue-collar workers.

Sources of Additional Information

A bibliography of career literature on management occupations is available from:

American Management Rssociation, 135 West 50th St., New York, N.Y. 10020.

BOILERMAKING OCCUPATIONS

Nature of the Work

Boilers, vats, and other large vessels that hold liquids and gases are essential to many industries. Boilers, for example, supply the steam that drives the huge turbines in electric utility plants and ships. Tanks and vats are used to process and store chemicals, oil, beer, and hundreds of other products. Layout workers and fitters help make the parts for these vessels, and boilermakers assemble them.

Layout workers (D.O.T. 809.381 and .781) follow blueprints in marking off lines on metal plates and tubes. These lines serve as guides to othe workers in the shop who cut the metal and then shape it on lathes or use other shaping tools such as grinders to produce the finished pieces. Layout workers use compasses, scales, gauges, and other devices to make measurements. Their measurements must be precise because errors may be difficult or impossible to correct once the metal is cut.

Before the boiler parts are assembled, *fitters* (D.O.T. 819.781) see that they fit together properly. These workers use bolts or temporary welds, called tackwelds, to hold the parts in place while they check the parts to see that they line up according to blueprints. Where alterations are necessary, fitters use grinders or cutting torches to remove excess metal, and welding machines to fill in small gaps. If large gaps appear, a new piece may have to be cut. Also, fitters use drills to line up rivet holes.

Small boilers may be assembled at the plant where they are made; however, once the pieces for a larger boiler or tank have been cut out and checked for a proper fit, they are transported to the shop or construction site where they are to be used. There, *boilermakers* (D.O.T. 805.281) assemble and erect the ves-

sels using rigging equipment such as hoists and jacks to lift heavy metal parts into place, and then weld or rivet the parts together. After a boiler is completed, they test it for leaks or other defects.

Construction boilermakers also install auxiliary equipment on boilers and other vessels. For example, they install vapor barriers on open-top oil, gas, and chemical storage tanks to prevent fumes from polluting in the air. Boilermakers also install air pollution control equipment, such as precipitators and smoke scrubbers, in electric plants that burn high sulfur coal.

Boilermakers also do repair jobs. For example, boilers occasionally develop leaks. When they do, boilermakers find the cause of the problem, and then they may dismantle the boiler, patch weak spots with metal stock, replace defective sections with new parts, or strengthen joints. Installation and repair work usually must meet State and local safety standards.

Places of Employment

About 34,000 boilermakers, layout workers, and fitters were employed in 1976. Of these, several thousand boilermakers worked in the construction industry, mainly to assemble and erect boilers and other pressure vessels. Boilermakers also were employed in the maintenance and repair departments of iron and steel plants, petroleum refineries, railroads, shipyards, and electric powerplants. Large numbers worked in Federal Government installations, principally in Navy shipyards and Federal powerplants. Layout workers and fitters worked mainly in plants that make fire-tube and water-tube boilers, heat exchangers, heavy tanks, and similar products.

Boilermaking workers are employed throughout the country, but employment is concentrated in highly industrialized areas, such as New York, Philadelphia, Chicago, Pittsburgh, Houston, San Francisco, and Los Angeles.

Training, Other Qualifications, and Advancement

Many people have become boilermakers by working for several years as helpers to experienced boilermakers, but most training authorities agree that a formal apprenticeship is the best way to learn this trade. Apprenticeship programs usually consist of 4 years of on-the-job training, supplemented by about 150 hours of classroom instruction each year in subjects such as blueprint reading, shop mathematics, and welding. Apprentices often have to travel from one area to another, since there is not always work available in their locality.

Most layout workers and fitters are hired as helpers and learn the craft by working with experienced employees. It generally takes at least 2 years to become a highly skilled layout worker or fitter.

When hiring apprentices or helpers, employers prefer high school or vocational school graduates. Courses in shop, mathematics, blueprint reading, welding, and machine metalworking provide a useful background for all boilermaking jobs. Most firms require applicants to pass a physical examination because good health and the capacity to uo heavy work are necessary in these jobs. Mechanical aptitude and the manual dexterity needed to handle tools also are important qualifications.

Layout workers and fitters may become boilermakers or advance to shop supervisors. Boilermakers may become supervisors for boiler installation contractors; a few may go into business for themselves.

Employment Outlook

Employment in boilermaking occupations is expected to increase much wasterthan the average for all occupations through the mid–1980's. In addition to the job openings resulting from employment growth, other openings will arise each year as experienced workers retire, die, or transfer to other fields of work.

The construction of many new electric powerplants, especially nuclear plants, will create a need for additional boilers and will cause employment of boilermakers, layout workers, and fitters to increase.

The expansion of other industries that use boiler products, such as the chemical, petroleum, steel, and shipbuilding industries, will further increase the demand for these workers. Also, as more laws are enacted to provide cleaner air, more boilermakers will be needed to install pollution control equipment.

Despite the expected overall increase in employment, most of the industries that purchase boilers are sensitive to economic conditions. Therefore, during economic downturns some boilermakers, fitters, and layout workers may be laid off, and others may have to move from one area of the country to another to find employment.

Earnings and Working Conditions

According to a national survey of workers in the construction industry, union wage rates for boilermakers averaged $10.03 an hour in 1976, compared with $9.47 for all building trades. Boilermakers employed in railroad shops averaged about $7 an hour in 1976.

Comparable wage data were not available for boilermakers employed in industrial plants. However, wage rates were available from union contracts that cover many boilermakers, layout workers, and fitters employed in fabricated plate work and the petroleum and shipbuilding industries in 1976. Most of these contracts called for hourly rates ranging from about $5.50 to $10. Generally, layout workers earned more than boilermakers, and boilermakers earned more than fitters.

When assembling boilers or making repairs, boilermakers often work in cramped quarters and sometimes at great heights, since large boilers may be over 10 stories tall. Some work also must be done in damp, poorly ventilated places. Thus boilermaking is more hazardous than many other metalworking occupations. Employers and unions attempt to eliminate injuries by promoting safety training and the use of protective equipment, such as safety glasses and metal helmets.

Most boilermaking workers belong to labor unions. The principal union is the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Other workers are members of the Industrial Union of Marine and Ship-

building Workers of America; the Oil, Chemical and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

For further information regarding boilermaking apprenticeships or other training opportunities, contact local offices of the unions previously mentioned, local construction companies and boiler manufacturers, or the local office of the State employment service.

BOILER TENDERS

(D.O.T. 951.885)

Nature of the Work

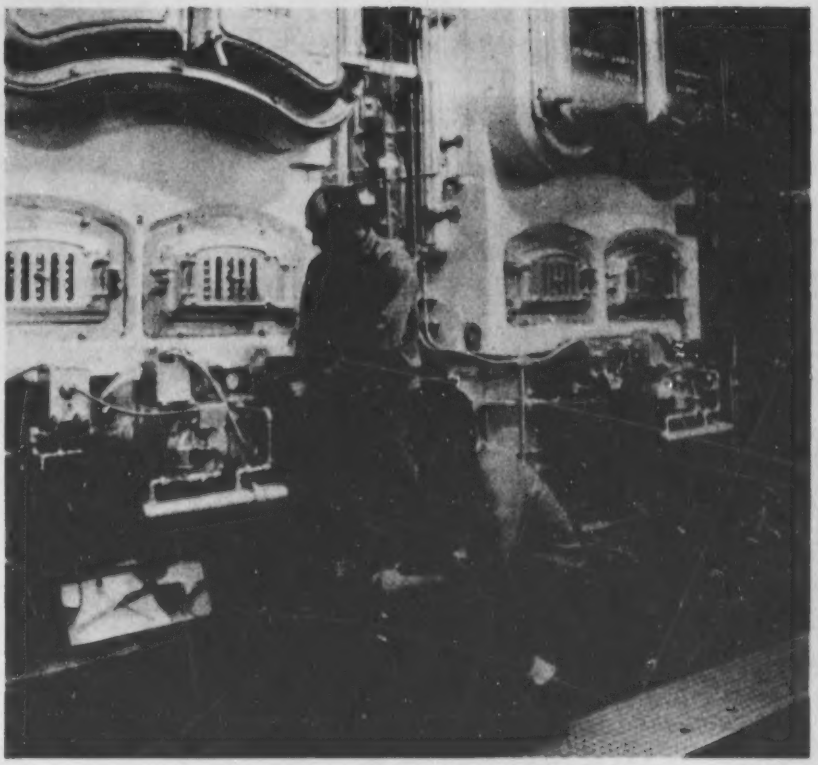
Boiler tenders operate and maintain the steam boilers that power industrial machinery and heat factories, offices, and other buildings. They also may operate waste heat boilers that burn trash and other solid waste.

Boiler tenders control the mechanical or automatic devices that regulate the flow of air and fuel into the combustion chambers. They may, for example, start the pulverizers or stokers to feed coal into the firebox or start the oil pumps and heaters to ignite burners.

These workers may be responsible for inspecting and maintaining boiler equipment. This includes reading meters and gauges attached to the boilers to ensure safe operation. Sometimes boiler tenders make minor repairs, such as packing valves or replacing faulty indicators.

Boiler tenders also chemically test and treat water for purity. In this way, they prevent corrosion of the boiler and buildup of scale.

Boiler tenders often are supervised by stationary engineers who operate and maintain a variety of equipment, including boilers, diesel and steam engines, and refrigeration and air-conditioning systems. (Additional information on stationary engineers appears elsewhere in the *Handbook*.)



Boiler tenders may advance to stationary engineers.

Places of Employment

About one-half of the 73,000 boiler tenders employed in 1976 worked in factories. Plants that manufacture lumber, iron and steel, paper, chemicals, and stone, clay, and glass products are among the leading employers of boiler tenders. Public utilities also employ many of these workers. Many others worked in hospitals, schools, and Federal, State, and local governments.

Although boiler tenders are employed in all parts of the country, most work in the more heavily populated areas where large manufacturing plants are located.

Training, Other Qualifications, and Advancement

Some large cities and a few States require boiler tenders to be licensed. An applicant can obtain the knowledge and experience to pass the license examination by first working as a helper in a boiler room. Applicants for helper jobs should be in good physical condition and have mechanical aptitude and manual dexterity. High school courses in mathematics, motor mechanics, chemistry, and blueprint reading also are helpful to persons interested in becoming boiler tenders.

There are two types of boiler tenders' licenses—for low pressure and high pressure boilers. Low pressure tenders operate boilers generally used for heating buildings. High pressure tenders operate the more powerful boilers and auxiliary boiler equipment used to power machinery in factories as well as heat large buildings, such as high-rise apartments. Both high and low pressure tenders, however, may operate equipment of any pressure if a stationary engineer is on duty.

Due to regional differences in licensing requirements, a boiler tender who moves from one State or city to another 4ay have to pass an examination for a new license. However, the National Institute for Uniform Licensing of Power Engineers is currently assisting many State licensing agencies in adopting uniform licens-

ing requirements that would eliminate this problem by establishing reciprocity of licenses.

Boiler tenders may advance to jobs as stationary engineers. To help them advance, they sometimes supplement their on-the-job training by taking courses in chemistry, physics, blueprint reading, electricity, and air-conditioning and refrigeration. Boiler tenders also may become maintenance mechanics.

Employment Outlook

Employment of boiler tenders is expected to decline through the mid-1980's as more new boilers are equipped with automatic controls. Nevertheless, a few thousand openings will result each year from the need to replace experienced tenders who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Boiler tenders had average hourly earnings of $6.20, according to a survey of 19 metropolitan areas in 1976. This was higher than the average for all nonsupervisory workers in private industry, except farming. The average for tenders in individual areas ranged from $3.63 in Greenville, S.C., to $7.48 in Detroit, Mich.

Modern boiler rooms usually are clean and well-lighted. However, boiler tenders may have to work in awkward positions and be exposed to noise, heat, grease, fumes, and smoke. They also are subject to burns, falls, and injury from defective boilers or moving parts, such as pulverizers and stokers. Modern equipment and safety procedures, however, have reduced accidents.

The principal unions organizing boiler tenders are the International Brotherhood of Firemen and Oilers and the International Union of Operating Engineers.

Sources of Additional Information

Information about training or work opportunities in this trade is available from local offices of State employment services, locals of the International Brotherhood of Firemen and Oilers, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Specific questions about the nature of the occupation, training, and employment opportunities may be referred to:

National Association of Power Engineers, Inc., 176 West Adams St., Chicago, Ill. 60603.

International Union of Operating Engineers, 1125 17th St. NW., Washington, D.C. 20036.

For information concerning reciprocity of boiler tenders' licenses among various cities and States, contact:

National Institute for Uniform Licensing of Power Engineers, 176 West Adams St., Suite 1911, Chicago, Ill. 60603.

ELECTROPLATERS

(D.O.T. 500.380 and .781 through .886)

Nature of the Work

Electroplating is a commonly used manufacturing process that gives metal or plastic articles a protective surface or an attractive appearance. Products that are electroplated include items as different as automobile bumpers, silverware, costume jewelry, and jet engine parts. In all cases, however, the object being plated is connected to one end of an electric circuit and placed in an appropriate solution. The other end of the electric circuit is connected to the plating material. By controlling the amount of electricity that flows from the plating material through the solution and to the object being plated, electroplaters control the amount of chromium, nickel, silver, or other metal that is applied to the final product.

Prior to electroplating any object, electroplaters study the job specifications which indicate the parts of the objects to be plated, the type of plating metal to be applied, and the desired thickness of the plating. Following these specifications, they prepare the plating solution by carefully adding the proper amounts and types of chemicals.

In preparing an article for electroplating, platers may first cover parts of it with lacquer, rubber, or tape to keep these parts from being exposed to the plating solution. They then either scour the article or dip it into a cleaning bath to remove dirt and grease before putting it into the solution.

Electroplaters must carefully inspect their work for defects such as minute pits and nodules. They may use a magnifying glass to examine the surface and micrometers and calipers to check the plating thickness.

Skill requirements and work performed vary by type of shop. All-round platers in small shops analyze solutions, do a great variety of plating, calculate the time and current needed for various types of plating, and perform other technical duties. They also may order chemicals and other supplies for their work. Platers in larger shops usually carry out more specialized assignments that require less extensive knowledge.

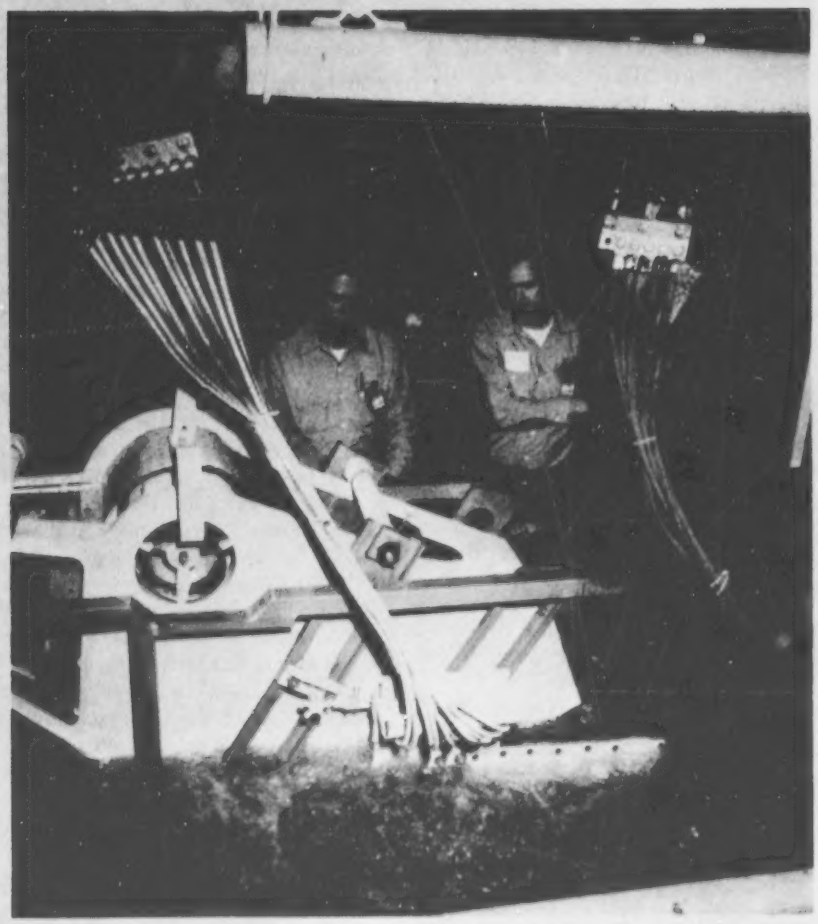
Places of Employment

About 36,000 people worked as electroplaters in 1976. About half of them worked in shops that specialized in metal plating and polishing for manufacturing firms and other customers. Virtually all of the remaining platers worked in plants that manufactured plumbing fixtures, cooking utensils, household appliances, electronic components, motor vehicles, and other metal products. The Federal Government employed a few platers for maintenance purposes at a number of military and civilian installations.

Electroplaters work in almost every part of the country, although most work in the Northeast and Midwest, near the centers of the metalworking industry. Large numbers 6f electroplaters work in Los Angeles, San Francisco, Chicago, New York, Detroit, Cleveland, Providence, and Newark.

Training, Other Qualifications, and Advancement

Most electroplaters learn the trade on the job by helping experienced platers. It usually takes at least 3 years to become an all-round plater.



Electroplaters dip aircraft wing pivot in plating solution.

Platers in large shops usually are not required to have an all-round knowledge of plating, and can learn their jobs in much less time. However, workers who receive such limited training generally have difficulty in transferring to shops doing electroplating with metals outside their specialty.

A small proportion of electroplaters receive all-round training by working 3 or 4 years as an apprentice. Apprenticeship programs combine on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity as applied to plating. Apprentices do progressively more difficult work as their skill and knowledge increase. By the third year, they determine cleaning methods, do plating without supervision, make solutions, examine plating results, and direct helpers. Qualified platers may become supervisors. Some electroplaters who understand the chemical processes of electroplating and the chemical characteristics of metals, and who have an outgoing personality, may become sales representatives for metal products wholesalers or manufacturers. Electroplaters with the necessary capital may go into business for themselves.

A few people take a 1- or 2-year electroplating course in a junior college, technical institute, or vocational high school. In addition, many branches of the American Electroplaters Society give basic courses in electroplating. Persons who wish to become electroplaters will find high school or vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading helpful.

Employment Outlook

Employment of electroplaters is expected to grow more slowly than the average for all occupations through the mid-1980's. Besides employment growth, other openings will result from the need to replace experienced workers who retire, die, 6r leave the occupation for other reasons. Opportunities are expected to be favorable for individuals who want jobs as electroplaters.

Expansion of the metalworking industries and the electroplating of a broadening group of metals and plastics are expected to increase the need for electroplaters. However, employment growth will be somewhat restricted by the increasing application of automated plating equipment and water effluent standards established by the Environmental Protection Agency. Such standards will require plants to install equipment with additional water pollution controls to prevent pollution of streams and waters. This new non-polluting plating equipment will increase cost of electroplating and thus will reduce the demand for electroplated products and electroplaters.

Earnings and Working Conditions

Hourly wage rates for electroplaters ranged from $2.75 to $9.80 in 1976, according to the limited information available. During apprenticeship or on-the-job training, a worker's wage rate starts at about 60 to 70 percent of an experienced worker's rate and progresses to the full rate by the end of the training period. Electroplaters normally receive premium pay for working night shifts.

Occupational hazards associated with plating work include burns from splashing acids and inhalation of toxic fumes. Humidity and odor also are problems in electroplating plants. However, most plants have ventilation systems and other safety devices that have reduced occupational hazards. Protective clothing and boots provide additional protection. Electroplaters are on their feet most of their workday and do much reaching, lifting, bending and carrying. Generally, mechanical devices are used for lifting, but at times the worker must

lift and carry objects weighing up to 100 pounds.

Some platers are members of the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, and the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Information on the availability of apprenticeships or on-the-job training may be obtained from State employment offices and local union offices. Training opportunities may also be located by contacting manufacturing plants and job shops that do electroplating.

For more specific information about job opportunities and training, write to:

American Electroplaters Society, Inc., 1201 Lousiana Avenue Winter Park, Florida 23609.

National Association of Metal Finishers, 22 South Park, Montclair, N.J. 07042.

FORGE SHOP OCCUPATIONS

Forging is one of the oldest methods of working and shaping metals. The exceptional strength of forged metal parts makes this an often used method of forming products that must withstand heavy wear. Many machine tools such as wrenches and drill bits are forged because they are subjected to constant stress and pressure.

The simplest forging method is hand forging done by a blacksmith. Modern forge shops, however, substitute heavy power equipment and dies (tools that shape metal) for the blacksmith's hammer and anvil. In this way, products can be forged in much greater quantity. Five employees operating a large forging machine can turn out more forgings in an hour than five blacksmiths can make in a year.

Most forgings are steel; but aluminum, copper, brass, bronze, and other metals also are forged. Nonferrous forgings are useful in many critical applications, for example, aircraft landing gear. Some of the advantages of nonferrous metal forgings are corrosion resistance and a lighter weight to strength ratio.

Forged products may be as small and lightweight as a key, or they may be as bulky and heavy as a piece of industrial machinery.

Nature of the Work

Before metal can be shaped, it must be heated in intensely hot furnaces (forges) until it is soft. Workers place the heated metal between two metal dies that are attached to power presses or hammers. With tremendous force, the hammers or presses pound or squeeze the metal into the desired shape. To finish the forging, other workers remove rough edges and excess metal and perform other finishing operations such as heat treating and polishing.

Two kinds of dies are used. The open die is flat and similar to the blacksmith's hammer, and is used when only a limited quantity of forgings or large-size, simple-shaped forgings are needed. The impression, or closed die, has a cavity shaped to the form of the metal part, and is used to produce large quantities of identical forgings.

Basic forge-shop equipment consists of various types of hammers, presses, dies, upsetters, and furnaces. Forge-shop workers also use handtools, such as hammers and tongs, to help mold and shape parts to fit exact specifications. Measuring devices such as rules, scales, and calipers are needed to inspect the finished products.

Descriptions of some major forge-shop production occupations follow.

Hammersmiths (D.O.T. 612.381) direct the operation of open die power hammers. They follow blueprints and interpret drawings and sketches so that the part being forged will meet specifications. Hammersmiths determine how to position the metal under the hammer and which tools are needed to produce desired angles and curves. They decide the amount of hammer force and if and when the metal needs additional heating.

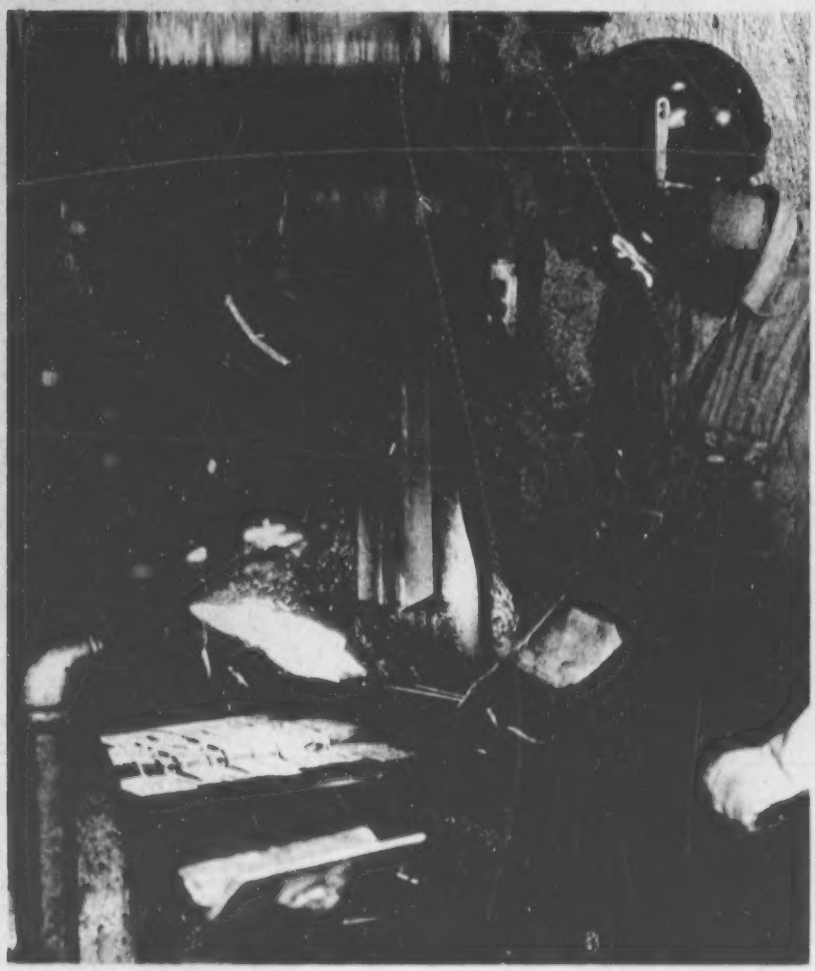
Hammersmiths head crews of four or more workers. A typical crew includes a hammer driver or hammer runner who regulates the force of the forging blow; a crane operator who transfers the metal from the furnace to the hammer and properly places it under the hammer; and a heater who controls the furnace that heats the metal to correct temperatures. The rest of the crew consists of one or more helpers to assist as needed.

The duties of *hammer operators* (D.O.T. 610.782), who operate impression die power hammers, are similar to those just described for hammersmiths. Generally the parts forged by closed die hammers are more intricate and detailed, thus these operators are highly skilled. With the assistance of a crew of helpers and heaters, hammer operators set and align dies in the hammers. They correctly position the metal under the hammer, control the force of the forging blow, and determine if and when the metal needs additional heating to make it easier to shape the metal to that of the die impression.

Press operators (D.O.T. 611.782 and .885) control huge presses equipped with either impression or open dies. These machines press and squeeze hot metal rather than hammer or pound it, and the operators regulate machine pressure and move the hot metal between the dies. They also may control the metal heating operations. Some operators set up the dies in the presses, using instruments such as squares and micrometers to make sure these are in place. Their skills are very similar to those of hammersmiths or hammer operators.

With the help of heaters and several helpers, *upsetters* (D.O.T. 611.782) operate machines that shape hot metal by applying horizontal pressure. The heads of nails and bolts, for example, are made by upset forging.

Heaters (D.O.T. 619.782) control furnace temperatures. They determine when the metal has reached the correct temperature by observing the metal's color and the furnace's temperature gauge. Using tongs or mechanical equipment, they transfer the hot metal from the furnace to ham-



Hammer operator shaping metal parts.

mers or presses. Some heaters clean furnaces.

Inspectors (D.O.T. 612.281) examine forged pieces for accuracy, size, and quality. They use tools such as gauges, micrometers, squares, and calipers to measure the exact dimensions of the forgings. Machines that test strength and hardness and electronic testing devices also may be used.

Die sinkers (D.O.T. 601.280) make the impression dies for the forging hammers and presses. Working from a blueprint, drawing, or template, these skilled workers make an outline of the object to be forged on two matching steel blocks. They measure and mark the object's shape in the blocks to form the impression cavity by using milling machines and other machine tools such as EDM (electrical discharge machinery) and ECM (electrical chemical machinery). Using handtools such as scrapers and grinders, and measuring tools such as calipers and micrometers, die sinkers smooth and finish the die cavity to fit specifications. Finally, a sample is prepared from the finished cavity and is checked against specifications.

Many forge-shop workers clean and finish forgings. For example, *trimmers* (D.O.T. 617.885) remove excess metal with presses equipped with trimming dies. *Grinders* (D.O.T. 705.884) remove rough edges with power abrasive wheels. *Sandblasters* or *shotblasters* (D.O.T. 503.887) operate sandblasting or shotblasting equipment that cleans and smoothes forgings. *Picklers* (D.O.T. 503.885) dip forgings in an acid solution to remove surface scale and reveal any surface defects. *Heat treaters* (D.O.T. 504.782) heat and cool forgings to harden and temper the metal.

Places of Employment

In 1976, about 71,000 production workers were employed in forge shops. About three-fourths of these worked in shops that make and sell forgings. The remainder worked in plants that use forgings in their final products, such as plants operated by manufacturers of automobiles, farm equipment, and handtools.

Although forge-shop workers are found in all areas, they are concentrated near steel-producing centers that provide the steel for forgings, and near metalworking plants that are the major users of forged products. Large numbers of forge-shop workers are employed in and around the cities of Detroit, Chicago, Cleveland, Los Angeles, and Pittsburgh.

Training, Other Qualifications, and Advancement

Most forge-shop workers learn their skills on the job. They generally join hammer or press crews as helpers or heaters, and progress to other jobs as they gain experience. Advancement to hammersmith, for example, requires several years of on-the-job training and experience.

Some forge shops offer apprenticeship training programs for skilled jobs such as diesinker, heat treater, hammer operator, hammersmith, and press operator. These programs usually last 4 years, and offer classroom training and practical experience in metal properties, power hammer and furnace operation, handtool use, and blueprint reading.

Training requirements for inspectors vary. Only a few weeks of on-the-job training are necessary for those who examine forgings visually or use only simple gauges. Others who inspect forgings that must meet exact specifications may need some background in blueprint reading and mathematics, and may be given several months of training.

Employers usually do not require a high school diploma, but graduates may be preferred. Persons interested in more skilled forge-shop jobs

should complete high school and take mathematics (especially geometry), drafting, and shopwork.

Although cranes are used to move very large objects, forge-shop workers must be strong enough to lift and move heavy forgings and dies. They also need stamina and endurance to work in the heat and noise of a forge shop.

Employment Outlook

Employment of forge-shop production workers is expected to increase more slowly than the average for all occupations through the mid-1980's. Some new jobs will become available because of growth, but most openings will arise from the need to replace experienced workers who or transfer to other fields of work.

Employment will grow because of expansion in industries that use forgings, particularly automobile and energy-related industries. The expansion of nuclear power plant construction will cause a great demand for forged piping and fittings. Likewise, many forged drilling bits and other forged products will be needed for oil drilling and coal mining operations. However, employment will not keep pace with forge shop production because improved forging techniques and equipment will result in greater output per worker.

Employment in some forge shops is sensitive to changes in economic conditions. In shops that make automobile parts, for example, employment fluctuates with changes in the demand for new cars; thus, jobs in these shops may be plentiful in some years, scarce in others.

Earnings and Working Conditions

Average hourly earnings of forge-shop production workers are higher than the average for all manufacturing production workers. In 1976, production workers in iron and steel forging plants averaged $6.86 an hour, compared to $5.19 an hour for production workers in all manufacturing industries.

Forge-shop occupations are more hazardous than most manufacturing occupations. However, improvements in machinery and shop practices have reduced some noise and vibration. For example, many forge shops have heat deflectors and ventilating fans to reduce heat and smoke. Also, labor and management cooperate to encourage good work practices through safety training and the required use of protective equipment such as face shields, ear plugs, safety glasses, metal-toed shoes, helmets, and machine safety guards.

Most forge-shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers. Others are members of the United Steelworkers of America; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Die Sinkers' Conference (Ind).

Sources of Additional Information

For information on employment opportunities in forging, contact local offices of the State employment service, personnel departments of forge shops, locals of the labor organizations listed above, or:

The Forging Industry Association, 55 Public Square, Cleveland, Ohio 44113.

The Open Die Forging Institute, 102 Pageant Ave., Rogers, Ark. 72756.

FURNITURE UPHOLSTERERS

(D.O.T. 780.381)

Nature of the Work

Whether restoring a treasured antique or simply giving an old living room couch a facelift, upholsterers combine artistic flair and skill to recondition sofas, chairs, and other upholstered furniture. These craft workers repair or replace fabrics, springs, padding, and other parts that are worn or damaged. (Workers employed in the manufacture of upholstered furniture are not included in this statement.)

The tasks involved in upholstering any piece of furniture are basically the same, although each job is unique in some ways because of differences in furniture construction. As the first step, upholsterers usually place the furniture on padded wooden benches or some other type of support so that they may work at a convenient level. Using hammers and tack pullers, they remove tacks holding the old fabric to the wooden frame. After stripping the old fabric, they remove the burlap and padding that cover the springs. Upholsterers examine the springs and remove broken or bent ones. If the nylon or cotton webbing—which hold the springs in place—is worn, upholsterers remove all the springs and all the webbing.

To rebuild the furniture, upholsterers may reglue loose sections of the frame and refinish exposed wooden parts. They then tack webbing to one side of the frame, stretch it tight, and tack it to the opposite side. Other webbing is woven across the first and attached to the frame in a similar fashion to form a mat. After putting springs on the mat so they compress evenly, upholsterers sew or staple each spring to the webbing or frame and tie each spring to the ones next to it. Burlap then is stretched over the springs, cut and smoothed, and tacked to the frame. To form a smooth rounded surface over the springs and frame, upholsterers cover all surfaces of the furniture with foam rubber, cotton pads, or other filling material. After sewing the padding to the burlap, they cover it with heavy cloth and tack the cloth to the frame. Finally, upholsterers put the new fabric cover, which has been cut to size and temporarily stitched together for fitting, on the furniture. After checking that the cover fits tightly and smoothly—or noting where adjustments are necessary—they remove the cover and sew it together. To complete the job, upholsterers put the cover back on the furniture; sew or tack on fringe, buttons, or other ornaments; and make pillow covers.

Upholsterers use a variety of handtools including tack and staple removers, pliers, hammers, and hand or power shears. They use special

Over three-fourths of all furniture upholsterers own and operate, or work in, small upholstery shops.

tools such as webbing stretchers and upholstery needles. They also use sewing machines.

Sometimes upholsterers pick up and deliver furniture. Those who own and manage shops order supplies and equipment and keep business records.

Places of Employment

About 27,000 people worked as furniture upholsterers in 1976. Over three-fourths of all furniture upholsterers own and operate, or work in small upholstery shops. These shops generally have less than three workers. Some upholsterers are employed by furniture stores. A few work for businesses, such as hotels, that maintain their own furniture.

Upholsterers work in all parts of the country. However, employment is concentrated in metropolitan areas, where the large population provides the greatest demand for the upholsterer's services.

Training, Other Qualifications, and Advancement

The most common way to enter this trade is to start as a helper in an upholstery shop and learn on the job. Helpers learn by upholstering furniture under the direction of experienced workers. Much time and practice are needed to learn complex tasks such as measuring and cutting the new fabric and sewing and attaching it to the frame with a minimum of waste. Usually about 3 years of on-the-job training are required to become a fully skilled upholsterer.

Inexperienced persons may get valuable training from vocational or high school courses in upholstery. However, additional training and experience in a shop are usually required before these workers can qualify as skilled upholsterers. In a few large cities, locals of the Upholsterers' International Union of North America run formal apprenticeship programs that last from 3 to 4 years. The programs place graduates of local vocational schools in upholstery shops where they receive on-the-job training.

Persons interested in becoming upholsterers should have good manual dexterity, coordination, and be able to do occasional heavy lifting. An eye for detail, good color sense, patience, and a flair for creative work are helpful in making upholstered furniture as attractive as possible.

The major form of advancement for upholsterers is opening their own shop. It is easy to open a shop because only a small investment in handtools is needed. However, the business is extremely competitive, so operating a shop successfully is difficult.

Employment Outlook

Little or no change is expected in employment of upholsterers through the mid-1980's. Most job openings will arise because of the need to replace experienced workers who retire, die, or transfer to other occupations.

More upholstered furniture will be used as population, personal income, and business expenditures grow. However, the demand for upholsterers will be limited because more people are buying less expensive furniture and replacing rather than reupholstering it.

Earnings and Working Conditions

Hourly wages for experienced furniture upholsterers ranged from $4.25 to $8 in 1976. Some highly skilled upholsterers earned over $10 an hour. Wages for inexperienced trainees ranged from $2.50 to $4 an hour. Upholsterers generally work 40 hours a week.

Working conditions in upholstery shops vary—many shops are spacious, adequately lighted, well-ventilated, and well-heated; others are small and dusty. Upholsterers stand while they work and do a considerable amount of stooping and bending and some heavy lifting.

Upholsterers usually buy their own handtools; employers provide power tools.

Some upholsterers are members of the Upholsterers' International Union of North America.

Sources of Additional Information

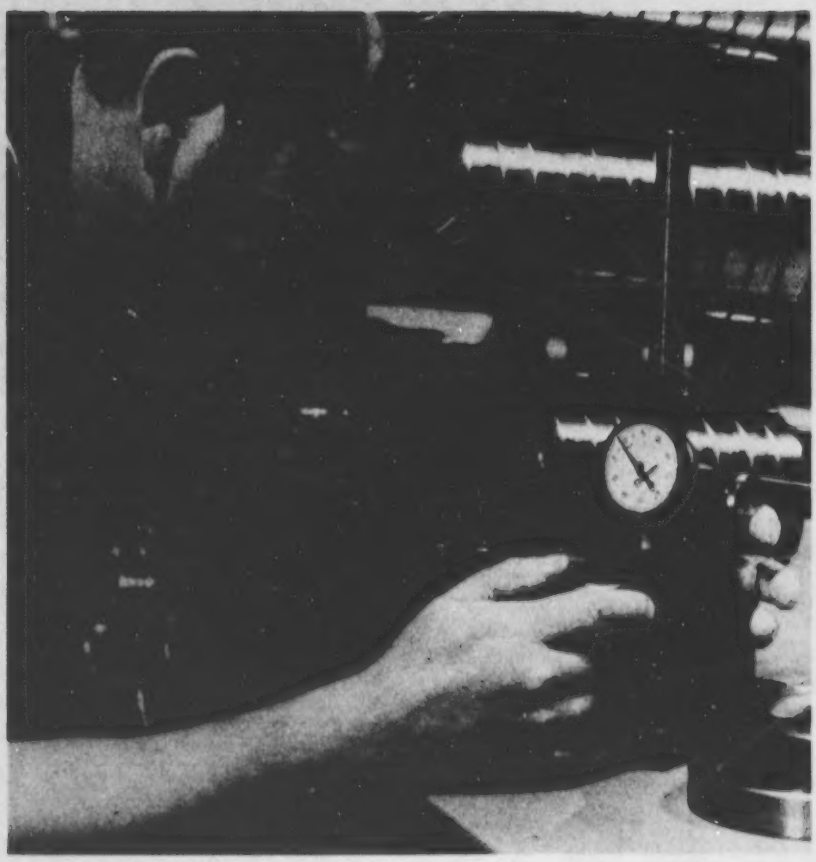
For more details about work opportunities for upholsterers, contact local upholstery shops or the local office of the State employment service.

INSPECTORS (MANUFACTURING)

Nature of the Work

Most products—including the things we eat, drink, wear, and ride in—are checked by inspectors sometime during the manufacturing process to make sure they are of the desired quality. Inspectors also check the quality of the raw materials and parts that make up finished goods.

A variety of methods are used to make certain that products meet specifications. Inspectors may taste-test a soft drink or examine a jacket for flaws, imperfections, or defects. They may use tools such as micrometers, protractors, gauges, and magnifying glasses to make sure that airplanes are assembled properly. Inspectors frequently make simple calculations to measure parts and examine work orders or blueprints to verify that products conform to standards.



Inspectors use a variety of instruments to test product quality.

Semiskilled inspectors usually work under close supervision, whereas skilled inspectors generally have more responsibility and less supervision. For example, skilled inspectors usually have authority to accept or reject most products, and often analyze the reasons for faulty construction and recommend corrective action. Skilled inspectors also may know how to use a wider variety of complex testing instruments.

Some inspectors make minor repairs and adjustments, such as filing a rough edge or tightening a bolt, and grade products for quality. In many plants, when the number of rejected items rises above a certain proportion, inspectors notify their supervisors.

Places of Employment

About 692,000 inspectors were employed in 1976. Two-thirds worked in plants that produced durable goods such as machinery, transportation equipment, electronics equipment, and furniture. Others worked in plants that produced goods such as textiles, apparel, and leather products.

Inspectors worked in every part of the country, although they were concentrated in the industrialized States. Almost two-thirds were found in Ohio, New York, Michigan, Illinois, Pennsylvania, California, New Jersey, North Carolina, and Indiana.

Training, Other Qualifications, and Advancement

Inspectors generally are trained on the job for a brief period—from a few hours or days to several months, depending upon the skill required.

Employers look for applicants who have good health and eyesight—with or without glasses—and who can follow directions and concentrate on details. Applicants should be able to get along with people since inspectors occasionally work as part of a team. A few large companies give preemployment tests to check skills such as the ability to work with numbers. Some employers may hire applicants who do not have a high school diploma but who have qualifying aptitudes or related experience. Other employers prefer experienced workers for inspection jobs. Many inspectors acquire the necessary skills and experience by working at various production line jobs, especially assembling.

Some semiskilled inspectors—particularly in metalworking industries—who take courses, such as blueprint reading and shop mathematics, may advance to skilled inspectors. After acquiring sufficient experience and knowledge, a few become quality control technicians or supervisors.

Employment Outlook

Employment of inspectors is expected to increase faster than the average for all occupations through the mid-1980's, with thousands of openings each year. As population and personal incomes grow, most manufacturing industries are expected to increase their output, and thus employment in the long run. This business growth will create a need for more industrial machinery and equipment. Additionally, the growing complexity of manufactured products should result in a need for more inspectors. Many openings will result as workers retire, die, or transfer to other occupations.

Inspectors seeking jobs in companies that produce durable goods, which are particularly sensitive to changes in business conditions, may find jobs scarce in some years, plentiful in others.

Earnings and Working Conditions

Wages for inspectors ranged from $2.70 to $7.02 an hour in 1976, according to information from a limited number of union contracts. Most inspectors covered by these contracts earned between $3.50 and $5.50 an hour.

Working conditions vary considerably for inspectors. For example, some have well lighted, air-conditioned workplaces in an aircraft or

missile plant; others, who work on the production floor of a machinery or metal fabricating plant, often are exposed to high temperatures, oil, grease, and noise.

Many inspectors are members of labor unions, including the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; the International Union of Electrical, Radio and Machine Workers; the International Brotherhood of Electrical Workers; United Steelworkers; and the Allied Industrial Workers of America.

Sources of Additional Information

Information about employment opportunities in this field may be available from State employment service offices.

The American Society for Quality Control certifies quality technicians. They also publish a careers booklet called "Careers in the Quality Sciences," which describes the occupation of inspector and includes information on quality engineering and management careers as well. For information about the test required for certification, or for a free copy of the booklet, write to:

American Society for Quality Control, 161 West Wisconsin Ave., Milwaukee, Wis. 53203.

MILLWRIGHTS

(D.O.T. 638.281)

Nature of the Work

With the coming of the Industrial Revolution, machines replaced many handcrafted items and new and bigger factories became necessary. The textile industry in England was one of the first to use machinery to mass produce its goods. The workers who planned and built these textile mills, and set up the equipment that was needed, were called millwrights. The occupation gradually expanded to other factories, and today the millwright installs all types of machinery in almost every industry.

The millwright is a skilled craftworker who may perform any or all of the tasks involved in preparing machinery for use in a plant. This often includes construction of concrete foundations or wooden platforms on which heavy machines are mounted. As they either personally prepare or supervise the construction of these structures, millwrights must know how to read blueprints and work with various building materials.

Millwrights also may have to dismantle existing equipment, for instance when it becomes obsolete or to make better use of factory space. Wrenches, hammers, pliers, metal cutting torches, and other hand and power tools are used to loosen and disassemble parts.

To aid in moving machinery, the millwright may use any number of rigging devices. For example, to install a new oven in a food processing plant, millwrights may use a hoist or a small crane to move the oven from the truck on which it arrived to a conveyor which would carry it into the plant. Then it may be lifted, with the aid of a crowbar for leverage, onto a dolly and taken to a foundation for proper positioning.

In assembling machinery, millwrights fit bearings, align gears and wheels, attach motors and connect belts to prepare a machine for use. Mounting and assembling a piece of equipment requires tools similar to those used in the dismantling process. When precision leveling is necessary, many measuring devices must be used. To set up automatic pinsetting equipment in a bowling alley, for example, plumb bobs—or weights which determine perpendicularity—must be attached. Millwrights also use squares to test right angles and calipers to measure diameter and thickness.

Many of the millwright's duties also are performed by industrial machinery repairers. (See the statement on industrial machinery repairers elsewhere in the *Handbook*.) This includes preventative maintenance, such as keeping machinery regularly oiled and greased, and fixing or replacing worn parts.

Millwrights employed by contract installation and construction companies do a variety of installation work. Those employed in factories usually specialize in installing the particular types of machinery used by their employers. They also may maintain plant equipment such as conveyors and cranes.

Places of Employment

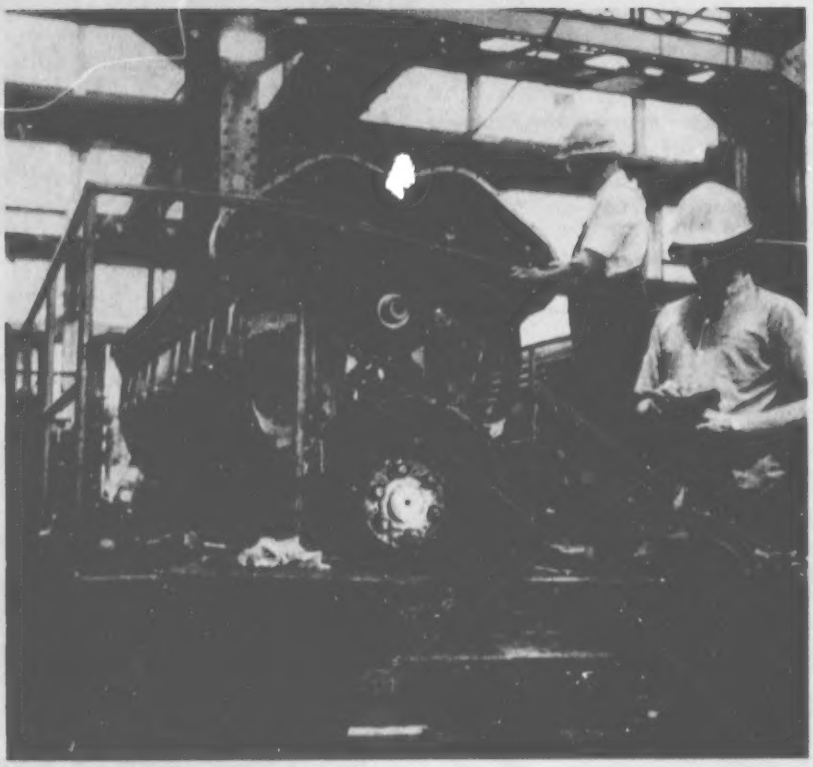
Most of the estimated 96,000 millwrights employed in 1976 worked for manufacturing companies; the majority were in transportation equipment, metal, paper, lumber, and chemical products industries. Others worked for contractors in the construction industry. Machinery manufacturers employed a small number to install equipment in customers' plants.

Millwrights work in every State. However, employment is concentrated in heavily industrialized areas such as Detroit, Pittsburgh, Cleveland, Buffalo, and the Chicago-Gary area.

Training, Other Qualifications, and Advancement

Some millwrights start as helpers to skilled workers and learn the trade informally on the job. This process generally takes 6 to 8 years. Others learn through formal apprenticeship programs which last 4 years. Apprenticeship programs include training in dismantling, moving, erecting, and repairing machinery. Helpers also may work with concrete and receive instruction in related skills such as carpentry, welding, and sheet-metal work. Classroom instruction is given in shop mathematics, blueprint reading, hydraulics, electricity, and safety.

Applicants for apprentice or helper jobs must be at least 17 years old. Some employers prefer to hire high school or vocational school graduates. Courses in science, mathematics, mechanical drawing, and machine shop practice are useful. Because millwrights often put together and take apart complicated machinery, mechanical aptitude is important. Strength and ability also are important, because the work requires a considerable amount of lifting and climbing.



Apprenticeship programs for millwrights generally last 4 years.

Employment Outlook

Employment of millwrights is expected to increase about as fast as the average for all occupations through the mid-1980's. Employment will increase as new plants are built, as existing plant layouts are improved, and as increasingly complex machinery is installed and maintained. Besides job openings from employment growth, thousands of openings will arise annually as experienced millwrights retire, die, or transfer to other occupations.

Earnings and Working Conditions

According to a survey of metropolitan areas, hourly wages for millwrights averaged $7.25 in 1976—more than one-third higher than the average wage for all nonsupervisory workers in private industry, except farming. Earnings for millwrights in 11 areas that represent various regions of the country appear in the accompanying tabulation:

Area	*Hourly rate*
Indianapolis	$7.81
Detroit	7.63
Houston	7.33
Baltimore	7.30
Cincinnati	7.21
Chicago	6.99
St. Louis	6.90
Minneapolis—St. Paul	6.75
New York	6.68
New Orleans	6.11

Millwrights employed by factories ordinarily work year round. Those employed by construction companies and companies that manufacture and install machinery may experience periods of unemployment; however, they usually are compensated with a higher hourly wage rate. Frequently these millwrights must travel.

The work of millwrights involves some hazards. For example, there is the danger of being struck by falling objects or machinery that is being moved. There also is the danger of falling from high workplaces, for millwrights must often climb up walkways and platforms to install equipment. In addition, millwrights are subject to usual shop hazards such as cuts and bruises. Accidents have been reduced by the use of protective devices such as safety belts and hats.

Most millwrights belong to labor unions, among which are the International Association of Machinists and Aerospace Workers; United Brotherhood of Carpenters and Joiners of America (construction millwrights); United Steelworkers of America; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; United Paperworkers International Union; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Firemen and Oilers.

Sources of Additional Information

For further information on apprenticeship programs, write to the Apprenticeship Council of your State's labor department, local offices of your State employment service, local firms that employ millwrights or:

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20001.

MOTION PICTURE PROJECTIONISTS

(D.O.T. 960.382)

Nature of the Work

Projectionists are key behind-the-scenes workers in motion picture theaters. From a booth in the back of the theater, projectionists operate movie projectors and sound equipment. Their duties vary with the type of equipment used.

In theaters with older equipment, projectionists use two projectors, sound equipment, a film rewinding machine, and seven reels of film or more. Before the movie begins, they examine the film, check the equipment to see that it works properly, and load the projectors with the first and second reels. After igniting and adjusting the extremely bright projector lamp which provides light for the screen, projectionists start the

first reel. If the picture is out of focus or unsteady, they adjust the projector lens. Volume controls also may be adjusted if the sound is too loud or too soft.

A reel of film lasts 20 minutes or more. When the reel is almost complete, cue marks (small circles in the upper right corner of the picture) signal that it is time to start the second projector. After a second series of cue marks appears, the projectionist simultaneously closes the shutter on the first projector and opens the second one. This changeover happens so quickly that the audience does not notice an interruption on the screen. Next, the projectionist removes the first reel and rewinds it on the rewinding machine. The entire process is repeated until all the reels have been shown. When the film breaks, the projectionist must rethread it rapidly so that the show may continue.

Almost all new theaters and many renovated theaters have automated or semi-automated equipment. When the film is properly programed or "set-up," the machines automatically can dim houselights, open curtains, start the show with picture and sound, change from one projector to another, and rewind the film. This equipment also uses larger reels, which lessen the number of projector changeovers. In theaters with automated equipment, the projectionist's main job is the "setup" of the film.

A movie comes from a film exchange company on 7 to 12 individual reels of film. The projectionist splices the film from these reels and rewinds it on 2 to 3 reels or on one "platter." The projectionist also cues the program by placing small metallic tabs on the film that activate the various functions of the machinery such as the film changeover. The film must then be carefully inspected for flaws, which may cause the film to break during the showing. The projectionist loads the projector, ignites the light, adjusts the sound and picture, and starts the show.

In case of trouble such as a break in the film, the equipment shuts off until the projectionist can correct the problem. When a movie has finished its run in a theater, the projectionist must replace the film on the smaller reels for return to the film exchange company.

Projectionists also clean and lubricate equipment, check for defective parts and damaged film, and make minor repairs and adjustments. For example, they may replace a badly worn projector sprocket. Major repairs are usually made by service technicians who specialize in repairing projection and sound equipment. However, employers sometime seek a projectionist who can do all the repair work.

Places of Employment

An estimated 16,500 motion picture projectionists were employed full time in 1976. The majority worked for indoor theaters; most of the remainder worked for drive-ins. Some projectionists worked for large manufacturing companies, colleges, television studios, and Federal, State, and local governments.

Projectionists work in cities and towns of all sizes throughout the country. However, most jobs are in large metropolitan areas.

Training, Other Qualifications, and Advancement

Most theaters in urban areas are unionized and young people seeking jobs as projectionists generally must meet union membership requirements. The union locals establish these membership requirements, and they vary considerably among the locals. In nonunion theaters young people may start as ushers or helpers and learn the trade by working with an experienced projectionist.

Generally, unions prefer that applicants be high school graduates. In a few cities and States, projectionists must be licensed. The license often must be obtained before applying for union membership.

Some locals only admit applicants who have had experience with projection equipment. These applicants may work for a trial period in several theaters under the supervision of the regular projectionist. If they demonstrate an adequate knowledge of the projection equipment and its operation, they may join the union. The trial period usually lasts several weeks and during that time the applicant receives no pay.

Some locals conduct training programs which usually require no previous experience with projection equipment. Trainees learn the trade by working with projectionists. They first learn simple tasks such as threading and rewinding film, and progress to more difficult assignments such as adjusting and repairing equipment. A trainee often works in several theaters to become familiar with different types of equipment. Some training programs include classroom instruction in basic electronics and mechanics. After training, the applicant must pass a written exam about equipment use and maintenance; the applicant then becomes a union member. Trainees are not paid for their work in the theaters.

Persons interested in becoming projectionists should have good eyesight—including normal color perception—and good hearing. They should be temperamentally suited to working alone. Manual dexterity and mechanical aptitude also are important qualifications. High school courses in mechanics and electronics or practical experience gained from operating 16-millimeter projectors at school or in the Armed Forces is helpful.

Advancement opportunities for projectionists are limited. Some, however, become projectionist-managers and run many of the theater's daily operations.

Employment Outlook

Little change is expected in employment of motion picture projectionists through the mid-1980's. Most job openings will occur as experienced workers retire, die, or transfer to other fields of work. Applicants may face keen competition for the jobs that become available. Because earnings of motion picture projectionists are relatively high, applicants frequently outnumber job openings. In some areas, new union members may only be able to work part time as replacements for full-time projectionists.

The number of movie theaters is expected to increase more slowly than in recent years, because lack of new films will hurt the theaters' ability to compete with other forms of entertainment such as television.

Furthermore, because of laborsaving innovations in equipment and theater design, employment of projectionists will not keep pace with theater growth. While older theaters had one screen and employed at least one projectionist, many new theaters are built with several screens side by side so that one projectionist, aided by automated projection machines and longer film reels, can run films for more than one auditorium at a time. The replacement of single screen theaters by those with multiple screens will slow the growth of projectionist jobs caused by new theater construction.

Earnings and Working Conditions

Average hourly earnings for projectionists in large metropolitan areas ranged from $5.18 to $16.50 in 1976, according to information from several union contracts. Wages vary among locals, the specific rate being determined by the type of theater, movie, and equipment involved. Generally, downtown theaters pay higher hourly rates than suburban or drive-in theaters. Projectionists who work more than one screen also receive extra pay.

Most projectionists work evenings; generally 4 to 6 hours on weekdays, and 10 hours or more on Saturday or Sunday. In theaters with weekday matinees, projectionists usually work 6 hours a day, 6 days a week. Some projectionists work at several theaters. For example, a weekly schedule may call for two evenings in each of three theaters. In small towns, projectionists usually work only part time because of the small number of shows. Projectionists employed at drive-ins—particularly in northern States—may be laid off for several months during the winter.

Projection rooms usually have adequate lighting and ventilation, and some are air-conditioned. The work is not strenuous and is relatively hazard free, but there is danger of electrical shock and acid burns from the projector's lamp if proper safety precautions are not taken. Although projectionists must stand a lot, they may sit for short periods while the equipment is operating. Most projectionists work without direct supervision and have infrequent contact with other theater employees.

Sources of Additional Information

Details about training programs and employment opportunities may be obtained from any local of the International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators of the United States and Canada.

OPHTHALMIC LABORATORY TECHNICIANS

(D.O.T. 711.381 and 713.884)

Nature of the Work

Ophthalmic laboratory technicians (also called *optical mechanics*) make eyeglasses ordered by dispensing opticians, eye physicians (ophthalmologists), and optometrists. The two types of ophthalmic laboratory technicians are surfacer (or lens grinder) and bench technician (or finisher). In small laboratories, one person may perform the tasks of both a surfacer and a finisher. Starting with standard size lens blanks, which large optical firms mass-produce, they set up and operate machines to grind and polish eyeglass lenses according to prescription specifications. Surfacers use precision instruments to measure the lenses and make sure that they fit the prescription. In large laboratories, work is divided into separate operations which are performed mainly by workers who operate power grinding and polishing machines.

Bench technicians mark and cut lenses and smooth their edges to fit frames. They then assemble the lenses and frame parts into finished glasses. Bench technicians use special tools, such as lens cutters and glass drills, as well as small files, pliers, and other handtools. They also use automatic edging machines

Technician grinds lens to prescription specifications.

to shape lens edges and precision instruments to detect imperfections. In large laboratories, the duties of bench technicians are divided into several operations which are performed mainly by semiskilled workers.

Places of Employment

About 22,000 persons worked as ophthalmic laboratory technicians in 1976. Most ophthalmic laboratory technicians work in ophthalmic laboratories. Some work for retail optical dispensaries or other stores that sell prescription lenses. A few work for eye physicians or optometrists who dispense glasses directly to patients.

Ophthalmic laboratory technicians are found in every State. However, employment is concentrated in large cities and in populous States.

Training, Other Qualifications, and Advancement

The vast majority of all ophthalmic laboratory technicians learn their skills on the job. At first, technician trainees do simple jobs such as processing lenses through a grinding machine. As they gain experience, they progress to other operations such as lens cutting and eyeglass assembly. When the trainees have acquired experience in all types of work, which usually takes about 3 years, they are considered all-round optical mechanics. Some technicians specialize in one type of job, such as surfacing or bench work. The training time required to become a specialist is less than that needed to become an all-round technician.

High school graduates also can prepare to become a technician through 3- to 4-year formal apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period. Most training authorities agree that technicians who learn as apprentices have more job opportunities and more opportunities for advancement than those without such training.

Apprentices are generally trained to be either ophthalmic surfacers or finishers. All apprentices receive instruction in optical mathematics and optical physics. Ophthalmic surfacers receive training in lens grinding and ophthalmic finishers learn to assemble eyeglasses into frames and to do frame repair.

Some technicians receive training while in the Armed Forces or by attending vocational schools which offer 9-month full-time optical technician courses. Graduates from these types of programs generally need additional on-the-job training.

Employers prefer applicants for entry jobs as ophthalmic laboratory technicians to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in and ability to do precision work are essential.

Some States require licenses for ophthalmic laboratory technicians. To obtain a license, the applicant generally must meet certain minimum standards of education and training, and must also pass either a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Ophthalmic laboratory technicians can become supervisors and managers. Some technicians become dispensing opticians, although the trend is to train specifically for optician jobs. Some technicians, especially those receiving their training in both shop and dispensing work, may go into business for themselves.

Employment Outlook

Employment of ophthalmic laboratory technicians is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the job openings from employment growth, some openings will arise from the need to replace experienced workers who retire, die, or leave the occupation for other reasons.

More technicians will be needed due to the rising demand for eyeglasses. The demand for eyeglasses is expected to increase as a result of increases in population and a greater awareness of the need for eyeglasses. State programs to provide eye care for low-income families, union health insurance plans, and Medicare also will stimulate demand. Moreover, the growing variety of frame styles and colors may encourage individuals to buy more than one pair of glasses.

Earnings and Working Conditions

Hourly wage rates for ophthalmic technicians ranged from $4.60 to $7.50 in 1976, based on information from a small number of union contracts.

Apprentices start at about 60 percent of the skilled worker's rate; their wages are increased periodically so that upon completion of the apprenticeship program, they receive the beginning rate for experienced workers.

Most ophthalmic laboratory technicians work a 5-day, 40-hour week.

Work surroundings of the ophthalmic technician are pleasant, well-lighted, and well-ventilated, but noisy because of the power-grinding and polishing machines.

Some ophthalmic laboratory technicians are members of unions. The principal union in this field is the International Union of Electrical, Radio and Machine Workers (AFL-CIO).

Sources of Additional Information

A list of schools offering courses for people who wish to become ophthalmic laboratory technicians is available from:

National Academy of Opticianry, 514 Chestnut St., Big Rapids, Mich. 49307.

National Federation of Opticianry Schools, 300 Jay St., Brooklyn, N.Y. 11202.

For general information about the occupation, contact:

International Union of Electrical, Radio and Machine Workers, 1126 16th St. NW., Washington, D.C. 20036.

Opticians Association of America, 1250 Connecticut Ave. NW., Washington, D.C. 20036.

PHOTOGRAPHIC LABORATORY OCCUPATIONS

(D.O.T. 970.281, 976.381, .687 through .887)

Nature of the Work

Amateur snapshots, home movies, professional portraits, and photo-

graphs to illustrate publications require the skills of thousands of photographic laboratory employees. These workers develop film, make prints and slides, and perform related tasks, such as enlarging and retouching photographs. (This chapter does not discuss employees of laboratories who specialize in processing professional motion picture film.)

All-round darkroom technicians (D.O.T. 976.381) can perform all tasks necessary to develop and print film. They know how to develop film manually, as well as how to operate and maintain any automatic equipment used in processing film. The technician varies the developing process according to the type of film—black-and-white negative, color negative, or color positive. For example, a developing process for black-and-white negative film covers five steps: developer, stop bath, fixing bath, washing, and drying. The first three steps use chemical solutions and are performed in darkness. In a hand operation, the technician first immerses unwound film in the developer, a solution that brings out the image on exposed film. When the film has remained in the developer for a specified period, the technician transfers it to a stop bath to prevent overdevelopment. Next, the film is placed in a fixing bath that makes it insensitive to light to prevent further exposure. Finally, the technician washes the film with water to remove the fixing solution and places the film in a drying cabinet. Although hand operations are performed in some small photographic studios, in many photographic labs technicians regulate machines that automatically perform the steps described above.

Processes for developing color films are more complex than those used for black-and-white. Thus, some labs employ *color technicians* (D.O.T. 976.381)—highly skilled workers who specialize in processing color film.

The darkroom technician makes a photograph by transferring the image from a negative to photographic paper. Printing frequently is performed on a projection printer, which consists of a fixture for holding negatives and photographic paper, an electric lamp, and a magnifying lens. The technician places the negative between the lamp and lens, and the paper below the lens. When the technician turns on the lamp, light passes through the negative and lens and records a magnified image of the negative on the paper. During printing, the technician may vary the contrast of the image or remove unwanted background by using paper patterns to shade part of the photographic paper from the projected image. After removing the exposed photographic paper from the printer, the technician develops it in much the same way as the negative. If the customer desires, the technician mounts the finished print in a frame or on a paper or cardboard back.

Some high schools and trade schools offer photography courses that include training in film processing.

In addition to working in the laboratory, darkroom technicians may set up lights and cameras or otherwise assist experienced photographers. Many technicians, particularly those who work in portrait studios and aspire to become professional photographers, divide their time between taking and processing pictures. In some labs, helpers assist technicians. They also may be assisted by workers who specialize in a particular activity, such as *developers* (D.O.T. 976.381), *printers* (D.O.T. 976.381), and *retouchers* (D.O.T. 970.281).

In most large photo labs where the film-developing processes are largely automated, darkroom technicians supervise semiskilled workers who do specialized assignments requiring only a limited knowledge of developing and printing. Included are *film numberers* (D.O.T. 976.887), who sort film according to the type of processing needed and number each roll for identification; *film strippers* (D.O.T. .976.884), who unwind rolls of film and place them in developing machines; *printer operators* (D.O.T. 976.782), who operate machines that expose rolls of photographic paper to negatives; *print developers, machine* (D.O.T. 976.885), who operate machines that develop these rolls of exposed photographic paper; *chemical mixers* (D.O.T. 976.884), who measure and combine the various chemicals that make up developing solutions; *slide mounters* (D.O.T. 976.885), who operate machines that cut, insert, and seal slides in cardboard or plastic mounts; and *photocheckers and assemblers* (D.O.T. 976.687), who inspect the finished slides and prints and package them for customers.

Places of Employment

In 1976, about 35,000 persons worked in photo lab occupations.

Most semiskilled workers are employed by large photofinishing labs that specialize in processing film for amateur photographers. A large proportion of darkroom technicians work in photo labs operated by portrait and commercial studios and by manufacturers, newspaper and magazine publishers, advertising agencies, and other organizations. Darkroom technicians also work in commercial labs that specialize in processing the work of professional photographers.

Photo lab workers are situated in all parts of the country, but employment is concentrated in the more populous areas such as New York, Los Angeles, Chicago, and other large cities.

Training, Other Qualifications, and Advancement

Most darkroom technicians learn their skills through informal on-the-job training. Beginners start as helpers and gradually learn to develop and print film by assisting experienced technicians. It generally takes

about 3 years to become a fully qualified darkroom technician. Some helpers become specialists in a particular activity, such as printing or developing. Generally, the training time required in order to become a specialist is less than is needed to become an all-round darkroom technician.

When hiring darkroom technician helpers, employers prefer applicants who are high school graduates. Courses in chemistry and mathematics are helpful to people interested in this trade. Some high schools and trade schools offer courses in photography that include training in film processing. The Armed Forces also offer training for darkroom technicians. Experience gained through processing film as a hobby is helpful.

Two-year curricula leading to an associate degree in photographic technology are offered by a few colleges. Completion of college level courses in this field is helpful to people who are interested in supervisory and managerial jobs in photo labs.

Many darkroom technicians eventually become professional photographers. (See statement on photographers elsewhere in the *Handbook*.) Others advance to supervisory positions in laboratories.

Training for workers in semiskilled photolab occupations ranges from a few weeks to several months of on-the-job training. For example, film numberers and slide mounters usually can learn their jobs in a few weeks, but printer operators and chemical mixers may need several months or longer. For many semiskilled jobs, manual dexterity, good vision including normal color perception, and good hand-eye coordination are important qualifications.

Employment Outlook

Employment in photo lab occupations is expected to increase faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

The need for semiskilled workers is tied closely to the growth of amateur photography. Film purchases by amateur photographers are expected to increase as a result of rising population and personal income. Improvements in still and movie cameras that make them easier to load and operate also should contribute to an increase in the use of film. However, due to the growing popularity of self-processing instant cameras and the increased use of mechanized film-processing equipment in photo labs, employment will not grow as fast as the amount of film used.

The need for all-round darkroom technicians is expected to increase as a result of the growing demand for photography in business and government. A major factor contributing to this demand will be the increasing variety of printed matter that is illustrated with photographs. The growing use of photography in research and development activities also will contribute to the demand for darkroom technicians.

Earnings and Working Conditions

Earnings of photo lab workers vary greatly and depend on factors such as skill level, experience, and geographic location. Inexperienced photo lab workers generally earned between $2.40 and $3.50 an hour in 1976, according to the limited information available. Workers in semiskilled occupations earned from $2.40 to $5 an hour. Among these workers, printer operators and chemical mixers generally had the highest earnings. In general, darkroom technicians and those in supervisory positions earned more than the semiskilled specialized workers. Most of the experienced darkroom technicians earned between $4.50 and $7.50 an hour in 1976.

The majority of photo lab employees work a 40-hour week and get premium pay for overtime. In labs that specialize in processing film for amateur photographers, employees may work a considerable amount of overtime during the summer and for several weeks after Christmas. Many labs employ temporary workers during these seasonal peaks.

Photo lab jobs are not physically strenuous, but in many of the semiskilled occupations the work is repetitious and the pace is rapid. Some workers (for example, printer operators and photocheckers and assemblers) are subject to eye fatigue. Photofinishing labs are generally clean, well-lighted, and air-conditioned.

Sources of Additional Information

For information about employment opportunities in photographic laboratories and schools that offer degrees in photographic technology, write to:

Photo Marketing Association, 603 Lansing Ave., Jackson, Mich. 49202.

Professional Photographers of America, Inc., 1090 Executive Way, Des Plaines, Ill. 60018.

Photographic Art and Science Foundation, 111 Stratford Rd., Des Plaines, Ill. 60016.

POWER TRUCK OPERATORS

(D.O.T. 922.883)

Nature of the Work

In the past, workers usually did the hard physical labor of moving materials and products. Today, many materials and products are moved by workers who operate various types of power trucks.

A typical power truck has a hydraulic lifting mechanism and forks to carry a load on a wooden skid or pallet, or other attachments to make it more versatile. For example, a truck may have a clamp lift to move cartons, bales, or paper rolls, a scoop to lift coal, or a tow bar to pull warehouse trailers.

Because the trucks are steered by the rear wheels and start and stop very quickly, operators must use care and skill in driving. Power trucks are relatively easy to operate; however, operators usually must follow special procedures when using a truck at a plant, warehouse, or construction site. For example, forks must be kept down if the truck is driven without a load. If the load is too high or wide to see around, the operator must drive the truck in reverse. When loading or removing materials that are stacked

on the floor or a platform, drivers must judge distance accurately and operate the truck smoothly so that no damage occurs to the stock. Operators also must know the lifting capacity of the truck and the kinds of jobs it can do.

Operators may have to keep records of materials moved and do some manual loading and unloading. They also may be responsible for keeping their trucks in good working condition by cleaning and oiling them, checking the water in batteries, making simple adjustments, and reporting any mechanical problems.

Places of Employment

About 360,000 persons worked as power truck operators in 1976. About three-fourths of them worked in manufacturing industries. Large numbers were employed in plants that made automobiles, machinery, fabricated metal products, paper, building materials, and iron and steel. Many power truck operators also were employed in warehouses, depots, freight and marine terminals, and mines.

Power truck operators are employed in all parts of the country. Although some are employed in small towns, most work in heavily populated areas where large factories are located.

Training, Other Qualifications, and Advancement

Power truck operators train on the job. Most workers can learn to operate a power truck in a few days. It takes several weeks, however, to learn the layout of the plant, the rules for operating a truck in the plant, and the most efficient way of handling materials.

Many companies have training programs that include classroom instruction and practice with the power truck. In the classes, trainees learn how the vehicle and its lift operate, proper methods of transporting materials, simple maintenance procedures, and safe driving rules. The programs stress practice with the power trucks. Trainees even may be required to operate them on an obstacle course. Training programs last 1 to 5 days. Because power trucks are becoming more versatile and expensive, firms are expected to place greater emphasis on training programs to increase the skills of their operators in order to avoid damage to trucks and materials from accidents.

Employers seek applicants who have average manual dexterity, strength, and stamina because operators must get on and off the truck frequently and occasionally load and unload material. Good eyesight, including good depth preception, is required to pick up, move, and deposit loads with the power truck. Large companies generally require applicants to pass a physical examination. Some mechanical ability is helpful because operators often are required to perform minor maintenance on their power trucks.

Opportunities for advancement are limited. A few operators may become supervisors.

Employment Outlook

Employment of power truck operators is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs resulting from employment growth, many operators will be needed to replace those who retire, die, or transfer to other occupations.

More goods will be manufactured as the population grows and our standard of living rises, and more power truck operators will be needed to move these goods and the materials used to produce them. The need for operators also will increase as more firms use power trucks in place of hand labor to move materials. The number of jobs available annually will vary, because the occupation is sensitive to changes in the demand for manufactured goods.

Earnings and Working Conditions

In 1976, power truck operators in manufacturing earned an average of $5.30 an hour, slightly above the average for nonsupervisory workers in private industry, except farming. Earnings of operators varied slightly by region and by industry.

Power truck operators are subject to hazards such as collisions and falling objects. They may operate their trucks outdoors where they are exposed to all kinds of weather. Some operators transport loose material that is dirty or dusty.

A trend toward quieter, more comfortable, and better handling trucks and emphasis on training in safe operation have improved working conditions. For example, all rider type power trucks now have overhead guards and many which are used outdoors are equipped with all-weather cabs. Also, the increasing use of the relatively noiseless and pollutant-free

Power truck operators are employed in many industries.

battery-powered trucks is doing much to improve the comfort of the operator. Moving materials throughout a plant also is likely to be less routine and boring than many other production jobs.

Sources of Additional Information

Information on work opportunities for power truck operators may be available from the local office of the State employment service.

PRODUCTION PAINTERS

Nature of the Work

Almost every metal or wood product manufactured gets a coating of paint or other finish before it leaves the factory. Automobiles, for example, usually receive rust preventative, primer, and paint totaling at least 10 coats. Even pencils are dipped in paint several times before they are packed into boxes.

The workers who apply the varnish, lacquer, paint, and other finishes used in factories are called production painters. Because they generally work on assembly lines, production painters' skills are different from those of painters who repair damaged cars in body shops and from those who paint newly constructed buildings. (Information on these painters can be found in separate statements elsewhere in the *Handbook*.) The majority of production painters use sprayguns to apply finishes; while the rest operate automatic painting machinery, such as spraying machines, dipping tanks, and tumbling barrels. Since painters may spray hundreds of identical items a day, the work may become repetitious.

Most paint is applied with spray guns.

Painters mix the paint at the beginning of the process. They first figure areas to be covered, and then follow directions to blend paint to its correct color and thickness. These steps require simple arithmetic involving decimals and fractions. Viscosity meters are used to make sure the paint is the right consistency, for if it is too thick or too thin, the paint has to be mixed over. Pressure of the spray gun nozzles and spray pattern controls also must be adjusted properly to ensure that the paint is evenly applied.

Besides spraying, painters are responsible for other duties on the production line. If an object is to be multi-colored, masking tape must be applied to keep colors from overlapping. Production painters who operate machinery set up the painting equipment at the beginning of the shift and are responsible for keeping it running. Other machines used in the painting process may also be operated by the painters. For example, washing tanks are used to clean items prior to painting and baking ovens dry the painted articles. At the end of the shift, painters must clean spray guns and other equipment used, such as mixing paddles or gauges which check paint consistency.

An increasing number of production lines use automatic painting machinery. Here, production painters are necessary to check for imperfections and to paint parts of an article that the machine misses. For example, some modern applicators cannot paint inside surfaces, such as the interior of a bucket. Painters use spray guns to paint these areas. As production lines become more automated, painters must learn to handle all types of modern painting machinery, such as electrostatic applicators and powder-type painting systems.

Places of Employment

About 104,000 production painters were employed in 1976. About two-thirds of the total worked in plants that made automobiles, machinery, furniture and other wood products, or manufactured metal products such as cans, tinware, and handtools. Although production painters are scattered geographically, large numbers are employed in industrialized States. A fourth of all furniture painters were employed in North Carolina and Pennsylvania, while one-third of all automobile painters worked in Michigan—over half of these in Detroit. Over a quarter of the painters employed by companies making machinery and metal products worked in Ohio and Illinois.

Training, Other Qualifications, and Advancement

Because no formal apprenticeship or training program exists, new production painters acquire their skills on the job. Inexperienced workers often start off loading and unloading items from conveyor lines. After they become familiar with the production process and as openings arise, they may be taught new painting skills. They usually learn the work by watching and helping experienced painters. Training varies from a few days to several months. Some modern painting processes, such as those used to apply powdered coatings, demand more skill than others and thus a correspondingly longer training period. As painters gain experience they can advance to higher skill categories, assume more responsibility, and receive higher wages.

Production painters usually have to stand for long periods of time to do their job. Although they seldom have to lift heavy objects, the production line nature of the job demands good physical condition, since the painters may be exposed to fumes or have to bend or stoop in their work. For example, to paint the underside or top of an object, such as a car, may require reaching or crouching. Good eyesight is an asset to distinguish colors and check that paint has been applied evenly. High school graduation is generally not required for entry level positions, but a diploma or its equivalent may be needed to advance to higher skill levels.

Opportunities for advancement are limited, although a small number

of production painters become supervisors.

Employment Outlook

Employment of production painters is expected to increase at about the same rate as the average for all occupations through the mid-1980's. Many job openings also will result as experienced workers retire, die, or transfer to other occupations.

Most manufacturing industries are expected to increase their output in the years ahead. Demand for consumer products, such as automobiles and furniture, will increase as population and personal income grow. Business growth will create a need for more industrial machinery and equipment. Employment of painters, however, is not expected to keep pace with manufacturing output because increased use of automatic painting processes and other labor-saving innovations should raise output per worker.

Most production painters work in plants that produce durable goods, such as automobiles, where employment is particularly sensitive to changes in general economic and business conditions. Therefore, these painters may be subject to occasional layoffs.

Earnings and Working Conditions

Hourly wage rates for production painters ranged from $2.63 to $6.12 in 1976, based on information from a limited number of union contracts. Most painters covered by these contracts earned between $4 and $5 per hour.

Because painters are exposed to fumes from paint and paint-mixing ingredients, they may wear masks which cover the nose and mouth. Many wear coveralls to protect their clothes. They also may need earplugs, since noisy factory conditions often exist. When painting large objects, such as a car or refrigerator, they may have to work in awkward and cramped positions.

Among unions organizing production painters are the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; International Association of Machinists and Aerospace Workers; and the United Steelworkers of America

Sources of Additional Information

More facts about job opportunities in this field may be available from local offices of the State employment service. General information on production painters may be obtained from:

Materials Marketing Associates, Inc., Shepard-Benning Building, 520 Pleasant, St. Joseph, Mich. 49085.

Federation of Societies for Coatings Technology, 1315 Walnut St., Philadelphia, Pa. 19107.

STATIONARY ENGINEERS

(D.O.T. 950.782)

Nature of the Work

Stationary engineers operate and maintain the machinery that provides power for industry; heat and air-conditioning for factories, hospitals, and other buildings; and light for every city and town. Among the equipment they tend and control are steam boilers, diesel engines, turbines, generators, pumps, condensers, and air compressors.

Stationary engineers monitor the various meters and gauges that are attached to equipment to make sure they are running properly, and make adjustments whenever necessary. On a steam boiler, for example, they check the meters and gauges that indicate steam pressure and the amount of fuel being consumed.

Stationary engineers, or power engineers as they often are called, check the equipment regularly to make sure that adequate power is provided without wasting fuel. They can control both the flow of fuel to the boiler and the steam pressure by adjusting throttles or valves. Other types of equipment may be regulated using switches or levers.

Stationary engineers also protect equipment from soot and corrosion. Boiler water, for example, frequently is tested for purity and treated with chemicals.

These workers detect and identify any trouble that develops. They watch and listen to machinery and routinely check the safety controls. Often stationary engineers make minor repairs, such as replacing defective valves, gaskets, or bearings.

In a large plant, the stationary engineer may be in charge of the boiler room, and direct the work of assistant stationary engineers, turbine operators, boiler tenders, and air-conditioning and refrigeration mechanics. In a small plant, the stationary engineer may be the only person operating and maintaining equipment.

Places of Employment

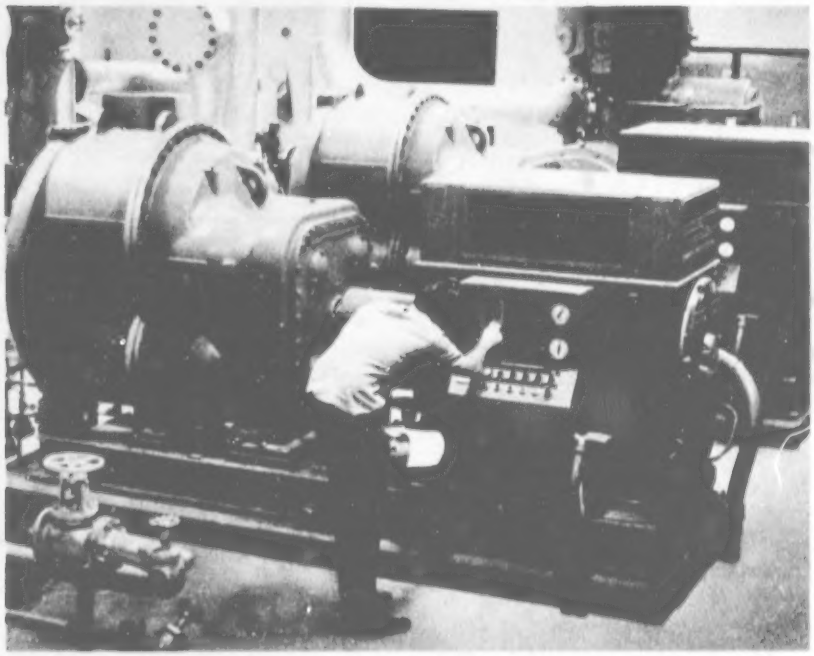
In 1976, 194,000 stationary engineers were employed in a wide variety of places, including power stations, factories, sewage and water-treatment plants, office and apartment buildings, hotels, and hospitals. Federal, State, and local governments also employed large numbers of these workers. Usually, plants that operate on three shifts employ four to eight stationary engineers, but some have more. In many plants, only one engineer works on each shift.

Because stationary engineers work in so many different kinds of industries, they are employed in all parts of the country. Although some are employed in small towns and in rural areas, most work in the more heavily populated areas where large industrial and commercial businesses are located.

Training, Other Qualifications, and Advancement

Many stationary engineers start as helpers or oilers and acquire their skills through informal on-the-job experience. A good background also can be obtained in the Navy or Merchant Marine. However, most training authorities recommend formal apprenticeship programs because of the increasing complexity of the machines and systems.

In selecting apprentices, most joint labor-management apprenticeship committees prefer high school or trade school graduates who have received instruction in mathematics, mechanical drawing, machine-shop



Stationary engineers operate generators and turbines.

practice, physics, and chemistry. Mechanical aptitude, manual dexterity, and good physical condition also are important qualifications.

The apprenticeship usually lasts 4 years. In addition to on-the-job training, apprentices receive classroom instruction in practical chemistry, elementary physics, blueprint reading, applied electricity, and other technical subjects.

Becoming a stationary engineer without going through a formal apprenticeship program usually takes many years of experience as an assistant to licensed stationary engineers or as a boiler tender. This practical experience can be supplemented by technical or other school training or home study.

Many States, the District of Columbia, and many large and medium-sized cities have licensing requirements for stationary engineers. Although requirements for a license differ from place to place, applicants usually must be at least 18 years of age, reside for a specified period in the State or locality in which the examination is given, meet the experience requirements for the class of license requested, and pass a written examination.

Generally, there are several classes of stationary engineer licenses. Each class specifies the steam pressure or horsepower of the equipment the engineer can operate. The chief engineer license permits the stationary engineer to operate equipment of all types and capacities. An applicant for this license may be required to have a high school education and an approved apprenticeship or on-the-job training. The lower class licenses limit the capacity of the equipment the engineer may operate without the supervision of a higher rated engineer.

Because of regional differences in licensing requirements, a stationary engineer who moves from one State or city to another may have to pass an examination for a new license. However, the National Institute for Uniform Licensing of Power Engineers is now assisting many States in adopting a standardized licensing program that would eliminate this problem by establishing reciprocity of licenses.

Stationary engineers advance to more responsible jobs by being placed in charge of larger, more powerful, or more varied equipment. Generally, engineers advance to these jobs as they obtain higher class licenses. Advancement, however, is not automatic. For example, an engineer who has a first-class license may work for some time as an assistant to another first-class engineer before a vacancy occurs. Some stationary engineers eventually advance to jobs as plant engineers and as building and plant superintendents. A few obtain jobs as examining engineers and technical instructors.

Employment Outlook

Employment of stationary engineers is expected to show little change through the mid-1980's. Nevertheless, several thousand job openings will arise annually because of the need to replace experienced workers who retire, die, or transfer to other occupations.

Industrial growth will result in an increased use of large boilers and auxiliary equipment in factories, powerplants, and other buildings. The need for additional stationary engineers, however, will be limited by she trend toward more powerful and more centralized equipment. For example, a large boiler operated by one stationary engineer can supply heat and refrigeration for several buildings, instead of each building having its own small boiler and its own engineer.

Earnings and Working Conditions

Stationary engineers had average hourly earnings of $7.03 in 1976, according to a survey of 21 metropolitan areas. This was almost 50 percent higher than the average for all nonsupervisory workers in private industry, except farming. Averages for engineers in individual cities ranged from $4.69 in Greenville, S.C. to $7.99 in the San Francisco area.

Stationary engineers generally have steady year-round employment. They usually work a 5-day, 40-hour week. In plants that operate around the clock, they may be assigned to any one of three shifts—often on a rotating basis—and to Sunday and holiday work.

Engine rooms, powerplants, or boiler rooms usually are clean and well-lighted. Even under the most favorable conditions, however, some

stationary engineers are exposed to high temperatures, dust, and dirt from the equipment. General maintenance duties may cause contact with oil and grease, and fumes or smoke. Workers also may have to crawl inside boilers and work in crouching or kneeling positions to inspect, clean, or repair the interiors.

Because stationary engineers often work around boilers and electrical and mechanical equipment, they must be alert to avoid burns, electric shock, and injury from moving machinery.

Among the unions to which these workers belong are the International Union of Operating Engineers and the International Brotherhood of Firemen and Oilers.

Sources of Additional Information

Information about training or work opportunities is available from local offices of State employment services, locals of the International Union of Operating Engineers, and from State and local licensing agencies.

Specific questions about the occupation may be referred to:

International Union of Operating Engineers, 1125 17th St. NW., Washington, D.C. 20036.

National Association of Power Engineers, Inc. 176 West Adams St., Chicago, Ill. 60603.

For questions concerning licensing requirements, contact:

National Institute for Uniform Licensing of Power Engineers, 176 West Adams St., Chicago, Ill. 60603.

WASTEWATER TREATMENT PLANT OPERATORS (Sewage-Plant Operators)

(D.O.T. 955.782)

Nature of the Work

Clean water is essential for our health and recreation and for the existence of fish and wildlife. Wastewater treatment plant operators help keep America's water clean by removing harmful domestic and industrial waste.

Waste materials are carried by water through sewer pipes to treatment plants. Operators control equipment to remove these materials or render them harmless. By operating and maintaining pumps, pipes, and valves that connect the collection system to the treatment facility, operators move the wastewater through the various treatment processes.

Operators read and interpret meters and gauges to make sure plant equipment is working properly. Other jobs include operating chemical feeding devices to remove pollutants from wastewater; taking samples of the water for laboratory analysis; and testing and adjusting the level of chlorine in the water. Operators also make minor repairs on valves, pumps, and other equipment. They use gauges, wrenches, pliers, and other common handtools, as well as special tools. Occasionally operators must work under emergency conditions—for example, a heavy rainstorm may cause abnormal amounts of wastewater to flow into sewer pipes and threaten to exceed a plant's treatment capacity.

The duties of operators vary depending on the type and size of plant. For example, the treatment process in an industrial plant, such as a food-processing company, may be simple since the wastewater is of a known content. Treatment plants that serve entire cities, on the other hand, must be equipped to treat a mixture of waste products that varies daily, thus making the operator's job more complicated. In smaller plants, one operator may be responsible for the entire system—making repairs, keeping plant records, handling complaints, and doing the maintenance work for the facility. In larger plants, the staff may include chemists, laboratory technicians, mechanics, helpers, supervisors, and a superintendent.

As a result of the passage of the Federal Water Pollution Control Act of 1972, water pollution standards will become increasingly stringent in the future. In order to meet these higher requirements, operators will have to be able to operate more sophisticated systems.

Places of Employment

About 100,000 people worked full time as wastewater treatment plant operators in 1976, of whom about 58,000 worked in municipal plants, 40,000 in private industry, and 2,000 in Federal installations.

Wastewater treatment plant operators are employed throughout the country. Geographically, employment is distributed much like the Nation's population, with most jobs in larger towns and cities. Many operators in small towns are employed part time.

Training, Other Qualifications, and Advancement

Trainees usually start as helpers and learn their skills on the job under the direction of an experienced operator. They learn by doing routine tasks such as recording meter readings; taking samples of wastewater and sludge; and doing simple maintenance and repair work on pumps, electric motors, and valves. They also are expected to perform housekeeping tasks such as cleaning and maintaining plant equipment and property.

Persons interested in entering the field should have some mechanical aptitude and should be competent in basic mathematics. Employers generally prefer trainees who have a high school diploma or its equivalent, and in some States this is a minimum educational requirement. Some positions, particularly in larger cities and towns, are covered by civil service regulations, and applicants may be required to pass written examinations testing elementary mathematics skills, mechanical aptitude, and general intelligence. Operators must be agile, since they have to climb ladders and move easily around heavy machinery.

Some 2-year programs leading to an associate degree in wastewater technology are available; these provide a good general knowledge of the water pollution control field as well as basic preparation for becoming an operator. Since plants are becoming more complex, completion of such courses increases an applicant's chances for employment and promotion.

Most State water pollution control agencies offer training courses to improve the skills of treatment plant operators. These courses cover principles of sludge digestion, odors and their control, chlorination, sedimentation, biological oxidation, and flow measurements. Some operators take correspondence courses on subjects related to wastewater treatment, and some employers will pay part of the tuition for courses leading to a college degree in science or engineering.

Operators may be promoted to positions such as supervisor and superintendent. A high school diploma and increasingly responsible operator experience may be sufficient to qualify as superintendent of a small plant, since at many small plants the superintendent also serves as an operator. Educational requirements, however, are rising as larger, more complex treatment plants are being built to meet new water pollution control standards. Superintendents of large plants are expected to have an engineering or science degree. Training in management techniques is becoming increasingly important for operators seeking positions with supervisory responsibilities. A limited number of operators may become technicians employed by State water pollution control agencies to monitor and provide technical assistance to plants throughout the State. Some technical-vocational school or junior college training generally is preferred for technician jobs.

In 40 States, supervisors and certain operators must pass an examination to certify that they are capable of overseeing treatment plant operations. Voluntary certification programs are in effect in the remaining States, with the exception of Alaska.

Under a typical program, there are different classes of certification for different sizes of treatment plants. For example, to be certified a "class I operator" capable of operating a small plant with simple equipment, an applicant should be a high school graduate, demonstrate general knowledge of treatment operations by passing a written test, and complete 1 year of satisfactory employment at a treatment plant. Requirements for certification as a class IV operator who supervises a large plant employing complex technology may require a bachelor's degree in science or engineering; 4 years of treatment plant experience, 2 years of which were in a position of major responsibility; and specific knowledge of the entire field of wastewater treatment as demonstrated through a written test. Typically, a large plant would employ mostly operators certified for operating small or medium-sized plants, but always under the supervision of a class IV operator.

Employment Outlook

Employment of wastewater treatment plant operators is expected to increase much faster than the average for all occupations through the mid-1980's, mainly as a result of the construction of new treatment plants to process the increasing amount of domestic and industrial wastewater. Also, more highly trained operators will be needed as existing plants expand and modernize their facilities to cope more effectively with water pollution. In addition to new jobs from employment growth, many job openings will occur as experienced operators retire, die, or transfer to other occupations.

People who enter this field should have fairly steady employment in the years ahead. Even during economic downturns, treatment plants seldom lay off employees.

Earnings and Working Conditions

Operators employed at small and medium-sized wastewater treatment plants generally earned between $9,000 and $13,000 a year in 1976. Some experienced operators earned more than $20,000 a year in large plants. Superintendents of small plants earned about the same as operators, but superintendents of medium-sized plants generally earned between $13,000 and $20,000 and as much as $25,000 or more in large plants. Salaries for trainees were roughly 80 percent of operators' salaries in most cities.

Because pollution control is a never-ending task, operators work different shifts and in an emergency may have to work overtime. Operators may be exposed to unpleasant odors, as well as noise from the operation of electrical motors and pumps. However, odor is kept to a minimum by the use of chlorine or other chemicals.

Sources of Additional Information

People interested in a career in wastewater treatment should contact their local or State water pollution control agencies. Additional information is available from:

Water Pollution Control Federation, 2626 Pennsylvania Ave., NW., Washington, D.C. 20037.

Manpower Planning and Training Branch (WH-596), Office of Water Programs, Environmental Protection Agency, Washington, D.C. 20460.

WELDERS

(D.O.T. 810. through 819.887)

Nature of the Work

Welding consists of joining pieces of material, usually metal, by fusing or bonding them together. It is the most common method of permanently connecting metal parts that go into the construction of automobiles, spacecraft, ships, household appliances, construction equipment, and thousands of other products. Beams and steel reinforcing rods in bridges, buildings, and roads frequently are joined by welding. In addition, a growing number of plastic parts are welded to make a variety of products.

Welding processes differ in the way heat is created and applied to the parts being joined. In arc welding, the most frequently used process, heat is created as electricity flows across a gap from the tip of the welding electrode to the metal. In resistance welding, heat is created by resistance to the flow of current through the metal. In gas welding, the combustion of burning gases melts the metal. As part of many welding processes, filler materials, called welding electrodes or welding

rods, are melted and added to the joint to give it greater strength. When the heat is removed, the metal and filler material solidify and join the parts. It is the welder's job to control the heat and the weld pool size and to add the filler material so that together they form a strong joint.

Since welding processes differ and are used for a wide variety of purposes, the equipment used and the skill levels of welders vary. Jobs vary from those of highly skilled manual welders who can use gas and electric arc welding equipment in more than one position and who can plan their work from drawings or other specifications to those of unskilled welding machine tenders who simply press a button to start the welding machine. Skilled welders know the material characteristics and properties of steel, aluminum, and other metals and can weld joints in all positions. For example, maintenance welders, pipe welders, and many of the welders who construct ships are skilled welders.

Ship welders join the steel plates, beams, and pipes used to build ships. Some welded joints are on the floor, some are on the wall, and some are overhead. All must be carefully welded to insure that the ship will not break apart in rough seas.

Ship welders generally use arc welding equipment, although gas equipment also is used in many areas. After reading instructions or specifications to learn which materials and welding method to use and obtaining supplies from the storage area, ship welders are ready to begin work. When employing shielded metal arc welding they use a rod in a holder attached to an electric cable coming from a welding power supply. The other power supply cable is attached to the metal being welded which completes the electrical circuit and controls are adjusted to provide the correct amount of welding current. When the power is turned on they "strike an arc" by briefly touching the rod to the metal to start the electricity flowing and then pulling the rod back to create a small gap which the current must jump. If the distance between the rod and the metal is correct, an arc will jump across the space; the heat from the electric arc melts the rod and the metal. Welders control the arc movement along the joint. As the rod melts and becomes shorter they move the holder closer to the metal to keep the correct arc length. When the rod becomes very short, it is discarded and replaced with a new one.

Maintenance welders repair tools, machines, and equipment—for example, a leaking pipe. In such cases, welders may bring their equipment to the job. Gas welding is used in many cases because electrical power may not be available and the torch, hoses, and tanks of gas are portable.

After examining the pipe and preparing the break for repair—usually by grinding—maintenance welders select the proper welding filler rod for the job. Next, they light the torch and adjust regulators on the tanks of fuel gas, such as acetylene, hydrogen, etc., and oxygen to obtain the right gas mixtures and flame. With the filler rod in one hand and the torch in the other, they heat the edges of the break and apply the heat. As the metal begins to melt, the welders periodically melt the end of the filler rod in the hot, liquid metal while they carefully move the torch and rod along the crack to complete the repair. Welders must be careful to keep the torch at the right distance from the metal in order to apply the heat correctly and to add filler material, as needed, to fill the crack.

Not all welders have the skills required of shipbuilding or maintenance welders. For example, less skilled workers use semiautomatic arc welding equipment to speed up the job of welding automobile frames. Semiautomatic equipment consists of a welding gun that welders must manipulate but which automatically supplies the proper amount of arc heat and filler material to the joint. In this case, assembly lines bring car frames to welders and put them in place. Welders then position their welding guns on the parts to be welded and operate a switch on the handle which automatically "strikes an arc". They guide the arc to complete one or two joints before the assembly line takes the frame to another worker. Like other welders, they are responsible for the soundness of the joint. However, they need less skill because all parts they weld are identical and each is welded in the same position.

If the factory is large, and many identical parts are to be welded, the company may save money by using automatic welding machines. Such machines may be used, for example, in making automobile mufflers and washing machines. The workers who operate these machines need little knowledge of welding and are frequently called welding machine operators to distinguish them from more skilled, manual welders. Welding machine operators place the parts to be joined in holders on the machine. To complete the weld, operators simply push a button. The machine then clamps the part in place and rotates it, as necessary, to complete the welding cycle. After

Jobs for welders are concentrated in the manufacturing centers of the Great Lakes States.

the welding cycle is finished, operators remove the welded parts and load the machine again.

Closely related to welders are cutters. Cutters use the heat from burning gases or an electric arc to cut and trim metal rather then join it. Some cutters operate electrically or mechanically controlled machines that automatically follow the proper guideline.

Places of Employment

About 660,000 welders and flame cutters were employed in 1976, including a relatively small number of cutters who used both flame and arc-cutting equipment. Almost two-thirds of all welders help manufacture durable goods; for example, boilers, bulldozers, trucks, ships, and heavy machinery. Most of the rest repair metal products or help construct bridges, large buildings, and pipelines.

Welders are concentrated in the manufacturing centers of the Great Lakes States. About one-third work in Pennsylvania, Ohio, Michigan, Indiana, and Illinois. Because of the widespread use of welding, the rest are distributed much the same as the population is with large numbers working in New York, Texas, Wisconsin, and California.

Training, Other Qualifications, and Advancement

Generally, it takes several years of training to become a skilled welder. Some of the less skilled jobs, however, can be learned on the job in a few months. Some welding machine operators, for example, learn to operate a machine in a few hours and become completely qualified in a week.

Beginners often start in simple production jobs where the type and thickness of the metal and the position of the welding operation rarely change. As the need arises, supervisors or experienced workers teach new employees how to weld different types of metals, and how to weld vertical and overhead joints. Many large companies conduct programs to train people as welders. After completing the course, individuals are offered jobs. A few companies offer employees welder apprenticeship programs that last several years, including classroom and on-the-job training.

Persons planning careers as welders or cutters need manual dexterity, good eyesight, and good eye-hand coordination. They should be able to concentrate on detailed work for long periods, and should be free of any physical disabilities that would prevent them from bending, stooping, and working in awkward positions. Most employers prefer applicants who have high school or vocational school training in welding. Courses in shop mathematics, mechanical drawing, blueprint reading, physics, and chemistry also are helpful.

New developments are requiring new skills of welders. This is particularly true in fields such as atomic energy or aerospace manufacturing, which have high standards for the reliability of welds. Before being assigned to work on buildings, bridges, pipelines, or other jobs where the strength of the weld is highly critical, welders may be required to pass an examination of their welding skills given by an employer or government agency. Welders who pass such examinations generally are referred to as "certified welders."

Promotion opportunities for welders are good. Some welding machine operators learn skilled welding jobs; skilled welders may be promoted to welding inspectors, technicians, or supervisors. Experienced workers who have obtained college training on the properties of metals often become welding engineers and are in great demand to develop new application for welding. A small number of experienced welders open their own welding repair shops.

Employment Outlook

Job opportunities for welders should be very good in the years ahead. Employment in this large field is expected to increase faster than the average for all occupations through the mid-1980's. The faster increase will be caused by the generally favorable long run outlook for metalworking industries and by the greater use of welding in particular. In addition to openings created by employment growth, many jobs should arise each year because of the need to replace experienced welders who retire, die, or transfer to other occupations. Job opportunities may vary from year to year, however, because employment of welders in the manufacturing and construction industries fluctuates with ups and downs in the economy.

Increases in population and income are expected to stimulate demand for cars, buildings, heavy machinery, appliances, and thousands of other products that welders help make. Employment of welders also is expected to increase as welding replaces other methods of joining metals. Welding generally is cheaper than other methods of joining metal parts, and it is being used more frequently in the manufacturing and construction industries.

Earnings and Working Conditions

National wage data on welders are not available. However, the limited data available indicate that welding machine operators earned from $3.93 to $5.10 in 1976. Welders in the construction industry earned $6 to $12 an hour, depending on location.

Welders and cutters use protective clothing, safety shoes, goggles, helmets with protective lenses, and other devices to prevent burns and eye injuries. Although lighting and ventilation usually are adequate, welders occasionally work in the presence of toxic gases and fumes created when some metals melt. They are often in contact with rust, grease, and dirt on metal surfaces. Welding machine operators are largely free from the hazards associated with manual welding. A face shield or goggles generally offer adequate protection to these workers.

Many welders are union members. However, because welding also is done by other craft workers, for example by pipefitters, and only recently has received recognition as a distinct craft, welders belong to many different unions. Among these are

the International Association of Machinists and Aerospace Workers; the International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.).

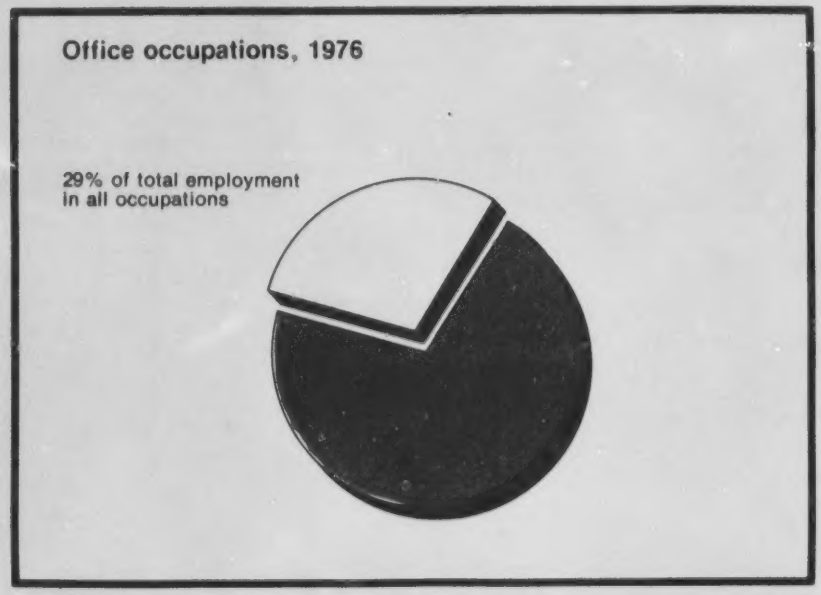
Sources of Additional Information

For further information on training and work opportunities for welders, contact local employers or the local office of the State employment service. For general information about welders, write to:

The American Welding Society, 2501 NW. 7th St., Miami, Fla. 33125.

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

OFFICE OCCUPATIONS



Office workers perform a wide range of tasks that are needed to keep business and other organizations running on a day to day basis. Clerical workers, such as secretaries and typists, maintain files, type, and operate office machines. Professional and technical employees give legal advice, prepare and analyze financial reports, design computer systems, and arrange bank loans.

Opportunities in office work exist for people with widely different educational backgrounds. Some jobs can be entered with only a high school education; many others, however, require at least a college degree.

Many clerical employees work with things and often do detailed, repetitive tasks. Most professional office workers, on the other hand, work with ideas; they apply their skills to solving problems and devising ways to provide better services to those who depend on them. Besides the technical skills required to do their jobs, office workers need judgment and the ability to communicate their ideas to others.

This chapter of the *Handbook* describes office work in clerical occupations, computer and related occupations, banking occupations, insurance occupations, and administrative and related occupations.

CLERICAL OCCUPATIONS

About 16 million people worked in clerical jobs in 1976. Many keep records and do other office paperwork. Others handle communications, operate office machines, ship and receive merchandise, and ring sales on cash registers.

Workers in clerical jobs have a wide variety of skills and experience. They include highly skilled title searchers in real estate firms and executive secretaries in business offices as well as relatively unskilled messengers and file clerks. Despite the diversity of jobs and duties, much clerical employment is concentrated in just a few familiar jobs. Roughly 1 of every 5 clerical workers is a secretary or stenographer. One in 10 is a bookkeeper. The accompanying chart shows employment in these and other major clerical occupations discussed in the *Handbook*.

Training, Other Qualifications, and Advancement

Clerical workers need high school diplomas for all but the most routine jobs, and many employers prefer applicants who have had business courses. Some companies cooperate with local high schools and business schools in office education programs that enable students to work part time while attending school. This experience is helpful for beginners seeking jobs after graduation. Many States and localities sponsor programs to train unemployed and low-skilled workers for entry-level clerical jobs.

Beginning clerical workers often receive on-the-job training. They learn how their employers keep records and become familiar with the kinds of business forms used. Some new workers learn to operate adding and duplicating machines and other kinds of office equipment. They may attend classes to learn how to operate tabulating machines and other specialized equipment. Secretaries, stenographers, and typists need special skills that must be learned in schools or formal training programs.

Many clerical jobs require reading comprehension, a knowledge of spelling and grammar, and arithmetic skills. Employers prefer applicants for almost all clerical jobs to have basic typing skills. Some employers test applicants for clerical aptitude.

Advancement opportunities for clerical workers are good, and many employers provide courses so that their employees can learn the skills needed for more demanding jobs. As workers become more highly skilled, they are assigned more difficult tasks. For example, junior typists may be promoted to more responsible jobs as senior typists as their typing speed and accuracy improves. Receptionists who learn typing and office procedures may become secretaries or typists. Promotion to supervisor or manager generally depends on leadership ability, work experience, and knowledge of the overall operations of the organization.

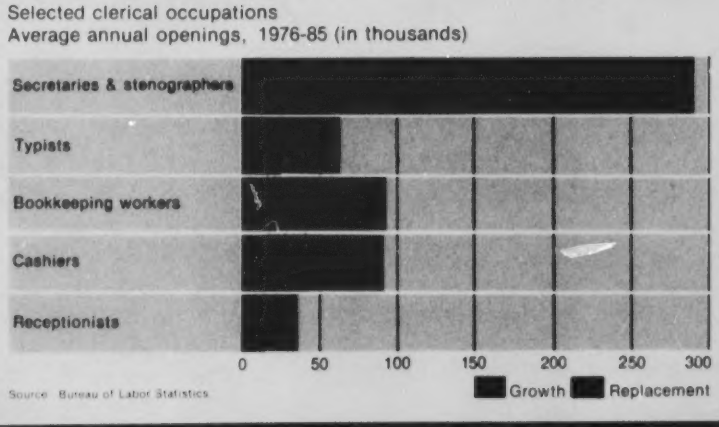
Employment Outlook

Employment of clerical workers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the new jobs created by this growth, many other openings will occur as employees die, retire, or leave their jobs.

Future growth in the number of clerical workers is expected to result primarily from the increasing paperwork that will accompany the expansion of large and complex organizations. A great deal of this paperwork is handled by computer. The impact of automation on office equipment and procedures is considerable, but it is more important in some jobs than in others. In general, long-term employment prospects are best in clerical occupations that are not affected by automation, in those that are compatible with computer applications, and in jobs that have developed as a result of new technologies. Job opportunities are especially favorable for receptionists, secretaries, and typists. Demand for these workers will be particularly strong in banks, insurance companies, manufacturing firms, and professional service organizations.

As more firms use computers and business machines, routine clerical

Openings for secretaries are expected to be more than three times the number of openings for any other clerical occupation through 1985



Source: Bureau of Labor Statistics

jobs such as payroll, bank, and file clerk may be reduced or eliminated. Also, as work is shifted from clerks to machines, many clerical workers will have to become familiar with computer operations, particularly in large firms.

Persons with clerical skills, particularly secretarial and typing skills, should find extensive opportunities for temporary or part-time work as more employers use these workers during peak business periods.

Earnings and Working Conditions

Clerks in routine jobs earned as little as $113 a week, while many highly skilled workers were paid $200 or more, according to a 1976 survey. Salary variations within an occupation are relatively common and these usually reflect differences in educational level, work experience, and level of responsibility.

Salaries in different parts of the country also vary; earnings generally are lowest in southern cities and highest in northeastern and western urban areas. For example, secretaries averaged $197 a week in the Northeast, $201 in the West, and $181 in southern cities.

Clerical employees work a 40-hour week in most cities. In some, especially in the Northeast, the scheduled workweek is 35 hours.

Most clerical workers in large cities receive 7 paid holidays or more a year and 2 weeks' vacation after working 1 year. Longer vacations, based on added years of service, may range to 4 weeks or more. Group life and health insurance plans, sick benefits, and retirement plans often are available.

Sources of Additional Information

Many State employment service offices can provide information about earnings, hours, and employment opportunities in clerical jobs.

Information concerning training for clerical occupations in your State is available from:

State Supervisor of Office Occupations Education, State Department of Education, State capital.

A directory of private business schools located in cities throughout the country may be obtained from:

United Business Schools Association, 1730 M St., NW., Washington, D.C. 20036.

BOOKKEEPING WORKERS

(D.O.T. 210.368 through .588, 216.388, and 219.388 and .488)

Nature of the Work

Every business needs systematic and up-to-date records of accounts and business transactions. Bookkeeping workers maintain these records in journals, ledgers, and on other accounting forms. They also prepare periodic financial statements showing all money received and paid out. The duties of bookkeeping workers vary with the size of the business.

In many small firms, *general bookkeepers* (D.O.T. 210.388) are the only bookkeeping workers. They analyze and record all financial transactions, such as orders and cash sales. They also check money taken in against that paid out to be sure accounts "balance," and calculate the firm's payroll. Although most of this work is done by hand, bookkeeping workers generally use simple office equipment such as calculating machines. General bookkeepers also prepare and mail customers' bills and answer the telephone.

In large businesses, a number of bookkeepers and accounting clerks work under the direction of a head or supervisory bookkeeper. In these organizations bookkeepers often specialize in certain types of work. For example, some prepare statements on a company's income from sales or its daily operating expenses. Others may post payments and charges on cards using bookkeeping machines, or feed information on accounts receivable and accounts payable into the computer. *Accounting clerks* (D.O.T. 219.488), sometimes known as bookkeeping clerks, perform a variety of routine duties. They record details of business transactions, including deductions from payrolls and bills paid and due. They also may type vouchers, invoices, and other financial records.

Bookkeeping workers need a knack for working with numbers.

Places of Employment

Bookkeeping workers numbered almost 1.7 million persons in 1976. Jobs for bookkeeping workers are found in all kinds of firms, with an especially large number in wholesale and retail trade. More than 1 of every 3 bookkeepers work for a retail store or wholesale firm. In addition, many work in factories, banks, insurance companies, hospitals, and schools.

Training, Other Qualifications and Advancement

High school graduates who have taken business arithmetic, bookkeeping, and principles of accounting meet the minimum requirements for most bookkeeping jobs. Some employers, however, prefer applicants who have completed business courses at a junior college or business school and have had some experience working with accounts payable and receivable. A knowledge of how computers are used to perform bookkeeping operations is an asset.

Persons also may qualify for bookkeeping jobs through on-the-job training. In some areas, companies cooperate with business schools and high schools in work-study programs. These programs offer part-time experience that helps students get jobs soon after graduation.

Bookkeeping workers need above average aptitude for working with numbers and a knack for concentrating on details. They should be able to type and operate various office machines. Because they depend on other office workers for information, bookkeepers should be able to work as part of a team.

Newly hired bookkeeping workers begin by recording routine transactions in accounts receivable or accounts payable units. They advance to more responsible assignments, such as preparing income statements and operating complex bookkeeping machines or computers. Some workers are promoted to supervisory jobs. Bookkeepers who complete courses in college accounting may become accountants. (The occupation of accountant is discussed elsewhere in the *Handbook*.)

Employment Outlook

Thousands of job openings for bookkeepers are expected every year through 1985. Jobs will be numerous even though employment of bookkeepers is expected to grow slowly over this period, for the occupation is large and turnover is high. Most job openings will occur because of the need to replace workers who die, retire, or stop working for other reasons.

Future employment growth in this occupation will be slowed by the increasing use of various types of bookkeeping machines and electronic computers that process data more accurately, rapidly, and economically than workers doing it by hand.

Earnings and Working Conditions

Beginning accounting clerks in private firms averaged $637 a month in 1976, according to a Bureau of Labor Statistics survey of clerical occupations. They had higher salaries, on the average, than beginning file clerks or typists, but earned less than beginning secretaries or stenographers. Experienced accounting clerks earned $805 a month, about the same as the average for all nonsupervisory workers in private industry, except farming.

In 1977, starting salaries in the Federal Government ranged from $6,572 (GS-2) to $7,408 (GS-3) for bookkeeping workers right out of high school. Starting salaries were higher for bookkeeping workers with at least 2 years' work experience or 2 years of college education. These salaries ranged from $8,316 (GS-4) to $9,303 (GS-5) per year. Average salaries in the Federal Government in 1977 for general accounting clerks were $13,443 per year.

Working conditions for bookkeepers are similar to those of other office workers in the same firms. (See introductory section to this chapter for more information on earnings and working conditions and for sources of additional information.)

CASHIERS

(D.O.T. 211.138, .368, .468, .488, and 299.468)

Nature of the Work

Supermarkets, movie theaters, and restaurants are among the many businesses that employ cashiers to handle payments from customers. Most cashiers receive money, make change, fill out charge forms, and give receipts. The related occupation of bank teller is discussed elsewhere in the *Handbook*.

In addition to these duties, cashiers, depending on their employers, may do other jobs and have different job titles. Those who work in theaters, for example, are often called *box office cashiers* or *ticket sellers*. They operate ticket-dispensing machines and answer telephone inquiries. Restaurant cashiers, sometimes called *cashier checkers*, may handle reservations for meals and special parties, type menus, or sell items at the candy and cigarette counter. In supermarkets and other self-service stores, cashiers known as *checkout clerks*, *checkers*, or *grocery clerks* wrap or bag purchases. They also may restock shelves and mark prices, rearrange displays of merchandise, and take inventory. In many offices, cashiers known as *agency* or *front-office cashiers*, type, operate the switchboard, do bookkeeping, and act as receptionists.

Cashiers operate several types of machines. Many use cash registers that print the amount of the sale on a paper tape. A rapidly growing number of cashiers operate electronic registers, computerized point-of-sale registers, or computerized scanning systems. Depending upon its complexity, a computerized system may automatically calculate the necessary taxes and record inventory numbers and other information. Such registers are replacing less versatile, conventional models in many stores. Cashiers who work in hotels and hospitals use machines that record charges for telephone, medical, and other services and prepare itemized bills. Cashiers also operate adding and change-dispensing machines.

Places of Employment

In 1976, about 1,250,000 persons worked as cashiers. More cashiers work in supermarkets and other food stores than in any other kind of store. However, cashiers are needed in businesses and organizations of all types and sizes, and many find jobs in department stores, drugstores, shoestores, hardware stores, furniture stores, and in other kinds of retail stores. Restaurants, theaters, schools, and hospitals also employ a large number of cashiers. Businesses employing cashiers are located in large cities, in suburban shopping centers, in small towns, and in rural areas. The Federal Government employs a small number, primarily in the Department of Defense.

Opportunities for part-time work are very good. Nearly half of all cashiers work part time; about 1 in 4 is a student.

Training, Other Qualifications, and Advancement

Employers prefer beginning cashiers with high school diplomas. Courses in business arithmetic, bookkeeping, typing, and other business subjects are good preparation for cashier jobs. Cashier training is offered as part of many public school vocational programs.

Many employers offer on-the-job training for cashiers. In a small firm, the beginning cashier is trained on the job by an experienced worker. In large firms, cashier training programs often include classroom instruction in the use of electronic or computerized registers and in other phases of cashiers' jobs.

Many persons enter cashier positions without significant prior work experience. For some cashier jobs, however, employers seek persons who have special skills or business experience, such as typing or selling. Many cashier openings also are filled by promoting other qualified workers who are already employed by the firm.

Persons who want to become cashiers should be able to do repetitious work accurately. They need finger dexterity, a high degree of eye-hand coordination, and an aptitude for working with figures. Because they meet the public, cashiers should be neat in appearance and able to deal tactfully and pleasantly with customers.

Promotion opportunities as cashiers tend to be limited. However, the cashier's job affords a good opportunity to learn an employer's business and so may serve as a steppingstone to a more responsible clerical job, such as bookkeeper or sales clerk, or to a managerial position. Cashiers working in chainstores and other large retail businesses, for example, may advance to department or store managers.

Nearly half of all cashiers work part time.

Employment Outlook

Job openings for cashiers are expected to be plentiful through 1985. Employment is expected to grow faster than the average for all occupations. Some new jobs will result from future growth in retail trade. However, much more important than growth as a source of jobs for cashiers is the need to replace workers who die, retire, or stop working for other reasons. Because the occupation is large and turnover is high, many cashier jobs will be available over the next 10 years.

Future employment of cashiers is likely to be affected by the use of computerized checkout systems, which are beginning to replace cash registers in some supermarkets. An optical or magnetic scanner transmits the code number (Universal Product Code-UPC) of each purchase to a computer that is programmed to record a description and price of the item, add the tax, and print out a receipt. The computer also keeps track of the store's inventory and places orders with the warehouse when stock is needed. The widespread adoption of automated checkout systems in supermarkets and other establishments is expected to slow employment growth of cashiers and other workers. However, resistance from consumer and labor groups may slow the adoption of such systems.

Earnings and Working Conditions

Beginning cashiers often earn the minimum wage required by law. In establishments covered by the Federal law, the minimum was $2.30 an

hour in early 1977. In addition, minimum wages in many establishments are governed by State law. Cashiers earn wages ranging from the minimum in a given establishment to several times that amount. According to a 1975 Bureau of Labor Statistics Survey of grocery stores, head cashiers averaged $5.78 an hour; other full-time cashiers, $5.32 an hour; and part-time cashiers, $4.31 an hour. Wages tended to be highest in the West and North Central Regions and lowest in the South; wages generally were higher in large metropolitan areas than in smaller cities.

Cashiers belong to a number of unions, principally the Retail Clerks International Association; International Brotherhood of Teamsters; and Retail, Wholesale, and Department Store Union. They generally receive health insurance, annual and sick leave, pension benefits, and other benefits available to other workers.

Cashiers often work during rush periods such as holidays, weekends, late afternoons, and evenings. Work at these times often is required in theaters, restaurants, and foodstores. Many cashiers in these places work part time or on split shifts. Full-time cashiers in supermarkets and other large retail stores usually work a 5-day, 40-hour week; however, they may work on weekends and have time off during the week.

Most cashiers work indoors, often in small booths or behind counters located near store entrances. In some cases, they are exposed to cold drafts in the winter and considerable heat during the summer. (See introductory section of this chapter for sources of additional information.)

COLLECTION WORKERS

(D.O.T. 240.368)

Nature of the Work

Companies that lend money or extend credit expect to be repaid. However, customers who "buy now" are not always able to "pay later." Collection workers, often called bill collectors, help maintain a company's financial well-being by keeping bad debts to a minimum.

A collector's primary job duty is to convince people to make good on unpaid bills. The collector usually receives a bad debt file after normal billing methods, such as monthly statements and collection form letters, have failed to elicit payment. The file contains information about the debtor, the nature and amount of the unpaid bill, and the last time payment was made.

The collector then contacts the debtor, determines why the bill is unpaid, and tries to get the debtor to pay or make new arrangements for payment.

The approach that collectors use depends on the type of payment problem they are handling. Sometimes customers feel that the bill is incorrect, or that the merchandise they bought is faulty, or that services they were billed for were not properly performed. Collectors normally recommend that the debtors resolve these disagreements by contacting the original sellers. In large stores, problems are referred to special "customer service" departments, set up to deal with disputed accounts. If the problems are not settled, the collectors again contact the customers to convince them that they were properly charged and should pay the debts.

When customers have met with financial emergencies or mismanaged their money, collectors may work out new payment schedules. If collectors find customers fraudulently avoiding payment of their bills, they may recommend that the files be turned over to an attorney.

When a debtor moves without leaving a forwarding address, the collector may inquire at the post office, search telephone directories, and call on the person's friends and former neighbors. In large collection operations, this may be done by collection workers known as "tracers."

In small organizations, bill collectors may perform other functions besides contacting delinquent customers. They may advise customers with financial problems, or contact customers to determine if they are satisfied with the way their accounts are being handled. Some collectors supervise the repossession procedure for businesses that reclaim goods when payment is not made.

Although most collectors do their work by phone, some make personal visits to the debtor. These visits usually are necessary when a large amount of money is involved and the debtor has been unresponsive to phone contact.

Places of Employment

About 64,000 persons were collection workers in 1976. Although collectors work for a variety of businesses, most are employed by banks, loan companies, and collection agencies. Many others work for retail and wholesale businesses.

Jobs for collectors are found throughout the United States, but opportunities are best in heavily populated urban centers. Many firms with branch offices in rural areas locate their collection departments in the business district of nearby cities.

Training, Other Qualifications, and Advancement

A high school education usually is sufficient for entry into the collection field. Because a collector handles delinquent accounts on a person-to-person basis, high school courses in psychology and speech may be useful. Previous employment as a sales clerk can help the collection worker learn how credit transactions originate and how they are handled at the point of sale. Knowledge of a foreign language may be an asset for persons seeking collection jobs in areas with large non-English-speaking populations.

Most of a collector's training is on the job. The employer may provide training manuals that explain collection procedures, but more often the new employee gains collection skills informally. For example, the new collector learns telephone techniques by listening as experienced workers make collection calls.

A collector's most important asset is the ability to get along with different people. He or she must be alert, imaginative, and quick-witted to handle the difficult situations that are a part of collection work. While collec-

tors should be sympathetic to the billpayers' problems, they also must be persuasive to overcome some debtors' reluctance to fulfill their financial obligations. Because a collector spends most of the day on the telephone, a pleasant speaking voice and manner are important.

The collector's job generally offers limited opportunities for advancement; competition for the few supervisory positions is keen. The collector with above-average abilities, however, may become a collection manager or supervisor of a staff of collectors. Some collection workers progress to other positions in the credit field, such as bank loan officer or outside representative for a collection agency. Further education, such as that available through professional associations of collectors or college courses, may be helpful for advanced positions in the credit and collection field.

Employment Outlook

The applicant with a background of high school business courses who can demonstrate effective telephone skills should find good job opportunities in the collection field. Demand is strongest for people who are personable, outgoing, and aggressive, for traits such as these are likely to lead to success on the job.

In the past, some jobseekers have been reluctant to accept collection work. More recently, however, the image of the occupation has improved. The role of the collector has expanded to include customer debt counseling, and collection methods have been modified in line with modern management techniques and recent consumer legislation. Despite this improved image, the number of persons seeking collection jobs is expected to fall short of the need for additional workers. Employers will need large numbers of collectors to fill vacancies created by turnover, which is relatively high in this occupation. In addition, new positions will open up as the occupation grows.

Employment opportunities should be best in collection agencies, where replacement needs continue to be high, and in retail trade firms, where earnings often are somewhat lower than the average. The strongest competition for collection positions will be in large metropolitan banks that generally offer higher salaries and better opportunities for advancement than other employers.

The demand for collection workers will be spurred by the expansion of credit card services.

The demand for collection workers will be spurred by the expansion of credit card services and the further growth of suburban retail stores. Delinquent accounts, unfortunately, are an unavoidable aspect of the credit system. As businesses extend attractive credit terms for the purchase of greater numbers of goods and services to more and more people, the number of delinquent accounts can be expected to increase. Additional collection workers will be required to service these accounts on a person-to-person basis.

Earnings and Working Conditions

Although earnings for collectors vary among employers, the limited information available indicates that beginning collectors earned about $125 a week in 1976, or about $6,500 a year. Managers of collection departments often earned $17,000 a year and more.

A survey by the American Collectors Association showed that telephone collectors working for collection agencies had an average monthly income of $823, or about $9,900 a year. Incomes of individual workers can vary substantially because collection agencies generally use some form of salary plus commission plan as an incentive to their collectors.

Commission schedules vary widely from agency to agency. A collector may be paid a relatively high salary with a low commission percentage or receive a low salary and a high rate on the money he or she collects for the agency. In some agencies, a quota is assigned to a collector or group of collectors and a bonus paid if the quota is reached. Earnings of a few collection workers are only from commissions.

In addition to salary, collectors receive the benefits common to other office occupations, such as paid vacations and health insurance. Those who occasionally make visits outside the office usually are furnished a company car or are paid expenses for using their own automobile.

Sources of Additional Information

Information on jobs as collection workers as well as other positions in a credit collection office is available from:

American Collectors Association, 4040 W. 70th St., Minneapolis, Minn. 55435.

FILE CLERKS

(D.O.T. 132.388, 205.368, 206.388, 219.588, 920.887)

Nature of the Work

An orderly file system is often the key to an efficient office. In most offices, records are arranged so that information can be located quickly. This creates many job opportunities for file clerks, who keep records accurate, up to date, and properly placed.

File clerks classify, store, update, and retrieve office information on request. To do this, they read incoming material and put it in order for future use by means of some system, such as by number, letter of the alphabet, or subject matter. When these records are requested, file clerks locate them and turn them over to the borrower. They keep track of materials removed from the files and make sure that those given out are returned.

File clerk operating a mechanical filer.

Some clerks operate mechanized files that rotate to bring the needed records to them. Others retrieve documents or spools of microfilm and place them in an electronic transmitter that displays the information on video terminals located elsewhere in the organization. Records also must be up to date in order to be useful. File clerks make sure that new information is added to existing files shortly after it is received.

From time to time, file clerks may destroy outdated file materials or transfer them to inactive storage. They check files at regular intervals to insure that all items are correctly placed. Whenever data cannot be located, the file clerk searches for the missing records. As an organization's needs for information change, file clerks modify old filing systems or establish new ones.

In small offices, file clerks often type, sort mail, or operate duplicating machines. Those who work with automated filing systems may code and microfilm all incoming documents.

Places of Employment

About 270,000 persons worked as file clerks in 1976. In addition, many other clerical workers perform some filing tasks in connection with their work. Opportunities for part-time work are abundant in this occupation; in 1976, approximately 1 of every 4 file clerks worked part time.

Although filing jobs are found in almost every kind of organization, about one-half of all file clerks work in banks, insurance companies, factories, or government agencies.

Training, Other Qualifications, and Advancement

Employers prefer high school graduates for beginning file clerk positions. Most seek applicants who can type, and many prefer those who have some knowledge of office practices as well. High schools, junior colleges, and private business schools teach these and other skills that help a beginner get a job. Many States and localities sponsor programs to train unemployed and low-skilled workers who can read and spell well for entry level clerical jobs such as file clerk.

Some on-the-job training usually is necessary because each organization has its own filing systems and office procedures. In organizations that have their own filing procedures, clerks learn their jobs in a few weeks. Learning to operate mechanical filing systems usually takes more time. Where file clerks have a variety of related duties, training may take up to 3 months.

File clerks must read accurately and rapidly, spell well, and like detailed work. Most file clerks must be able to type. They should be neat, able to work as part of a team, and not be easily bored by repeated tasks.

File clerks can advance to more difficult filing duties and to jobs supervising other file clerks. Those who learn additional skills may be promoted to office machine operators, receptionists, and typists.

Employment Outlook

Employment of file clerks is expected to grow about as fast as the average for all occupations through the mid-1980's as business expansion creates a need for more and better recordkeeping. In addition, a large number of file clerks will be needed each year to replace those who die, retire, or transfer to other jobs.

The growing volume of paper work and continued expansion of those businesses that traditionally have employed many file clerks should assure steady employment growth. However, this growth should be slower than in past years as computers are used more extensively to arrange, store, and transmit information. Jobseekers who have typing and other secretarial skills and are familiar with a wide range of office machines should have better opportunities than less experienced applicants. File clerks should find many opportunities for temporary or part-time work, especially during peak business periods.

Earnings and Working Conditions

According to a recent survey, beginning file clerks in urban areas averaged $113 a week in 1976. Those with some experience averaged $128; those with a great deal of experience, $158. File clerks earned somewhat less than three-fourths of the average earnings of nonsupervisory workers in private industry, except farming.

In the Federal Government, beginning file clerks without high school diplomas started at about $112 a week in 1977, and high school graduates began at $126 a week. Experienced file clerks in the Federal Government averaged about $171 a week in 1977.

Working conditions for file clerks usually are similar to those for other office workers in the same organization. Although they do not do heavy lifting, they often must stoop, bend, and reach. (See the statement on Clerical Occupations for information on fringe benefits and sources of additional information.)

HOTEL FRONT OFFICE CLERKS

(D.O.T. 242.368)

Nature of the Work

Hotels and motels employ front office clerks to handle room reservations, greet guests, issue keys, and collect payments. In small hotels and in many motels, front office clerks also may work as bookkeepers, cashiers, or telephone operators. Large hotels usually employ several front office clerks to handle different jobs, such as receiving mail, providing information, or issuing keys. In the largest hotels, floor clerks distribute mail, packages, and telegrams to guests. About 62,000 persons worked as front office clerks in 1976.

Room or *desk clerks* assign rooms to guests and answer questions about hotel services, checkout time, or parking facilities. In assigning rooms, they must consider guests' preferences while trying to maximize hotel revenues. These clerks fill out guests' registration forms and sometimes collect payments. Room clerks are always in the public eye and through their attitude and demeanor, greatly influence guests' impressions and promote a hotel's reputation.

Reservation clerks record written or telephoned requests for rooms, prepare registration forms, and notify room clerks of guests' arrival times.

Rack clerks keep records of room assignments to advise housekeepers, telephone operators, and maintenance workers that rooms are occupied.

Training, Other Qualifications, and Advancement

Employers usually select high school graduates who have some clerical aptitude as front office clerks. A knowledge of bookkeeping is helpful for work in a small hotel or on the night shift, because clerks often have a wider range of duties under these circumstances. Occasionally, employees in other hotel occupations, such as bellhops or elevator operators, may be transferred to front office jobs.

Front office work traditionally has been the pathway to managerial positions in the hotel industry. Although education beyond high school generally is not required for front office work, college training is an asset for advancement to managerial jobs. Neatness, a courteous and friendly manner, and a desire to help people are important traits for front office clerks. Knowledge of a foreign language can be helpful for work in large hotels or resorts that receive many foreign guests.

Newly hired workers usually begin as mail, information, or key clerks and receive their training on the job. The training period is usually brief and includes an explanation of the job's duties and information about the hotel, such as room locations and services offered. Once on the job, they receive help and supervision from the assistant manager or an experienced front office worker. Some clerks may need additional training in data processing or office machine operation because of the increased use of computerized reservation systems.

Most hotels promote front office workers from within so that a key or mail clerk may be promoted to room clerk, then to assistant front office manager, and later to front office manager. Clerks may improve their opportunities for promotion by taking home study courses in hotel management such as those sponsored by the Educational Institute of the American Hotel and Motel Association. (See the statement on Hotel Managers and Assistants elsewhere in the *Handbook*.)

Neatness, a courteous and friendly manner, and a desire to help people are important for front office clerks.

Employment Outlook

Employment of front office clerks is expected to grow more slowly than the average for all occupations through the mid-1980's. Employ-

ment growth will be limited by the use of computerized reservation systems in most hotel and motel chains, and most job openings will result from the need to replace workers who die, retire, or leave the occupation.

See the statement on the Hotel Industry elsewhere in the *Handbook* for information on earnings and working conditions, sources of additional information, and more information on employment outlook.

OFFICE MACHINE OPERATORS

(D.O.T. 207.782, .884, and .885; 208.782; 213.782; 214.488; 215.388; 216.488; and 234.)

Nature of the Work

To speed the paperwork involved in operating a business, most firms employ office machine operators to record information, determine bills and inventories, and perform other calculations. This statement describes some of the more common machine operating jobs.

Advances in data transmission devices will enable large employers to centralize recordkeeping.

Billing machine operators (D.O.T. 214.488) prepare customer statements by typing information, such as customers' names, purchases, and amount of sales, on a billing machine that automatically computes the balances and required payments.

Bookkeeping machine operators (D.O.T. 215.388) record a firm's financial transactions on a bookkeeping machine and calculate trial balances, summary reports, and other necessary data.

Adding and calculating machine operators (D.O.T. 216.488) use mechanical adding machines and electronic calculators to compute payrolls and invoices and do other statistical work. Some calculators can also be used to compute square roots and percent distributions.

Mail preparing and mail handling machine operators (D.O.T. 234.) use machines to open incoming mail and prepare bills and letters for mailing. Some machines fold and insert enclosures, while others address, seal, and stamp envelopes. Addressing machines print addresses on envelopes using stencils or metal plates prepared by *embossing machine operators* (D.O.T. 208.782) using special typewriters.

Duplicating machine operators (D.O.T. 207.782, .884, and .885) operate equipment that can reproduce letters, bills, invoices, and other documents. Included are mimeograph, stencil, and copying machines. These workers keep the machines loaded with paper, see that they are properly adjusted for the number of copies to be made, and may collate—put together—pages of lengthy documents by hand or machine.

Tabulating machine operators (D.O.T. 213.782) operate machines that sort and total large quantities of accounting and statistical information and print the results on special business forms.

Information about workers in several other occupations that use office machines can be found elsewhere in the *Handbook*, in the statements on computer and peripheral equipment operators, typists, and statistical clerks.

Places of Employment

In 1976, about 163,000 people worked as office machine operators. About one-fifth worked for manufacturing companies; large numbers also were employed by banks, insurance companies, and wholesale and retail stores. Many office machine operators work for service firms that prepare monthly bills and mailing circulars for businesses that do not have their own office machinery.

Training, Other Qualifications, and Advancement

Employers prefer high school or business school graduates for jobs as office machine operators. Most newly hired workers are expected to be able to type and operate adding machines and calculators. A knowledge of business arithmetic is helpful.

The amount of instruction and on-the-job training beginners receive depends on the types of machines they operate. Although a few days of training usually are sufficient to train duplicating machine operators, several weeks may be needed to train bookkeeping machine operators. Some office machine operators are trained at company expense in schools run by equipment manufacturers.

Finger dexterity, good eye and hand coordination, and good vision are important for most office machine operator jobs. Billing and calculating machine operators should know simple arithmetic so they can detect obvious errors in computations. Some mechanical ability is advantageous, especially for duplicating and tabulating machine operators.

Most employers promote from within and give strong consideration to seniority and job performance as shown by supervisors' ratings. Promotion may be from a routine machine job to a more complex one, or to a related clerical job. Employers often provide any additional training that may be required. In firms having large clerical staffs, office machine operators may advance to jobs where they train beginners or to supervisory

positions as section or department heads.

Employment Outlook

Employment of office machine operators is expected to grow more slowly than the average for all occupations through the mid-1980's. Most openings will result from the need to replace workers who die, retire, or leave the occupation.

Despite expected growth in the volume of billing, computing, and duplicating work, the occupation will expand slowly as computerized recordkeeping and processing systems spread. In addition, advances in data transmission devices will enable large employers to centralize recordkeeping, and to reduce the requirements for operators in branch offices.

Earnings and Working Conditions

A 1975 Bureau of Labor Statistics survey of earnings for several office machine operator occupations in urban areas showed that the lowest salaries were paid in the South and the highest in the North and West.

For some occupations averages are given separately for different skill groups. Operators in Class A were very experienced and performed comparatively difficult work. Those in Classes B and C had some or no experience, worked on more routine assignments, and used simpler equipment. The average weekly salaries reported in this survey are shown in the accompanying tabulation:

	Average weekly salaries, 1976
Billing machine operators	$160
Bookkeeping machine operators:	
Class A	170
Class B	140
Tabulating machine operators:	
Class A	240
Class B	200
Class C	160

Billing and bookkeeping machine operators earned slightly less than the average for all nonsupervisory workers in private industry, except farming.

Because some types of office machines are very noisy, operators may work in special areas apart from other company offices. In other respects, their working conditions are similar to those of other office workers in the same firms. (See the statement on clerical occupations for further information on working conditions and for sources of additional information.)

POSTAL CLERKS

(D.O.T. 231.388 and 688, 232.138 and .368)

Nature of the Work

Most people are familiar with the post office window clerk who works behind the counter selling stamps or accepting parcel post. However, the majority of postal clerks are distribution clerks who sort incoming and outgoing mail in workrooms.

Postal clerks work either at local post offices or at large central mail processing facilities. At local post offices postal clerks sort the mail for delivery to individual customers. Incoming mail collected from the local neighborhood boxes is forwarded to the nearest mail processing center where clerks continue the process of sorting and preparing the mail for delivery.

There are more than 300 mail processing centers throughout the country which service the local post offices in designated geographic areas. Once mail is received at a center, letter sorting machine clerks, distribution clerks, and mailhandlers separate the mail into groups of letters, parcel post, magazines, and newspapers. Then mailhandlers feed the letters through stamp-canceling machines. After this step is completed, mailhandlers take the mail into other workrooms to be sorted according to destination. There, clerks read the ZIP codes and simply push keys corresponding to the letters' destinations on electronic mail-sorting machines; the letters drop into the proper slots. Finally, the mail is sent from the mail processing center to local post offices or to other centers for further sorting.

The clerks at post office windows provide a variety of services in addition to selling stamps and money orders. They weigh packages to determine postage and check to see if their condition is satisfactory for mailing. Clerks also register and insure mail and answer questions about postage rates, mailing restrictions, and other postal matters. Occasionally they may help a customer file a claim for a damaged package. In large post offices, a window clerk may provide only one or two of these services and may be called a registry, stamp, or money order clerk.

Places of Employment

Two out of every five employees of the U.S. Postal Service were postal clerks in 1976. The majority of the 270,000 postal clerks work at mail processing centers, although many still sort mail and provide window services at local post offices throughout the country.

Training, Other Qualifications, and Advancement

Postal clerks must be at least 18 (at least 16 if they have a high school diploma) and qualify on a four-part written examination. The first part tests clerical accuracy by asking the applicant to compare pairs of addresses and indicate which are identical. The second part tests ability to memorize mail distribution systems. The third measures reading ability, including vocabulary, and the fourth tests ability to do simple arithmetic. Applicants must also pass a physical examination and may be asked to show that they can lift and handle mail sacks weighing up to 70 pounds. Applicants who are to work with an electronic sorting machine must pass

Postal clerks sorting incoming mail.

a special examination which includes a machine aptitude test

Applicants should apply at the post office or sectional center where they wish to work because each keeps a separate list of those who have passed the examination. Applicants' names are listed in order of their scores. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. Disabled veterans who have a compensable, service-connected disability of 10 percent or more are placed at the top of the list. When a vacancy occurs, the appointing officer chooses one of the top three applicants; the rest of the names remain on the list for future appointments.

New clerks are trained on the job. Most clerks begin with simple tasks to learn regional groupings of States, cities, and ZIP codes. To help clerks learn these groups, many post offices offer classroom instruction.

A good memory, good coordination, and the ability to read rapidly and accurately are important. Distribution clerks work closely with other clerks, frequently under the tension and strain of meeting mailing deadlines. Window clerks must be courteous and tactful when dealing with the public, especially when answering questions or receiving complaints.

Postal clerks are classified as casual, part-time flexible, part-time regular, or full time. Casual workers are hired to help handle the large amounts of mail during peak mailing periods at various times throughout the year, such as the Christmas season. Part-time flexible employees do not have a regular work schedule, but replace absent workers or help with extra work loads as the need arises. Part-time regular workers have a set work schedule—for example, 4 hours a day.

Most clerks begin as part-time flexible employees and become full-time workers as vacancies occur. Full-time clerks may bid for preferred assignments such as the day shift, a window job, or a higher level nonsupervisory position as expediter or window service technician. Clerks may qualify to become supervisors.

Employment Outlook

Employment of postal clerks is expected to decline through the mid-1980's due to falling mail volume and installation of more efficient sorting machines. The amount of mail handled by the postal service is expected to decrease because of rising postal rates, greater use of telephones, and development of other ways of distributing advertising circulars. Nevertheless, many job openings will result from the need to replace clerks who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Postal clerks working full time started at $12,422 a year in 1976, but

could advance to $15,007 after 8 years with satisfactory performance. Clerks working part-time flexible schedules started at $6.18 an hour and could advance to $7.46 an hour after 8 years. Clerks working part-time regular schedules started at $5.97 an hour and could advance to $7.21 an hour after 8 years. All clerks who work night shifts receive 10 percent additional pay. Besides good pay, full-time postal employees have more job security than workers in most other industries. (For information on fringe benefits, see statement on Postal Service occupations elsewhere in the *Handbook*.)

Working conditions of clerks differ according to the specific work assignments and the amount and kind of laborsaving machinery in the post office. In small post offices, clerks may carry heavy mail sacks from one part of the building to another, and sort the mail by hand. In large post offices and mail processing centers, chutes and conveyors move the mail and much of the sorting is done by machine. In either case, clerks are on their feet most of the time, reaching for sacks and trays of mail and placing packages and bundles into sacks and trays while walking around the workroom.

Distribution clerks may become bored with the routine of sorting mail unless they enjoy trying to improve their speed and accuracy. They also may have to work at night or on weekends, because most large post offices process mail around the clock.

A window clerk, on the other hand, has a greater variety of duties, has frequent contact with the public, generally has a less strenuous job, and rarely has to work a night shift.

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities for postal clerks.

RECEPTIONISTS

(D.O.T. 235.862, 237.368)

Nature of the Work

All organizations want to make a good first impression on the public. This is an important part of the job of the receptionist, who generally is the first person a caller sees.

Receptionists greet customers and other visitors, determine their needs, and refer callers to the official who can help them. Receptionists in hospitals, after obtaining personal histories, direct patients to the proper waiting rooms; in beauty shops, they arrange appointments and show customers to the operator's booth; and in large plants, they provide callers with identification cards and arrange escorts to take them to the proper office.

Many receptionists keep business records of callers, the times at which they called, and the persons to whom they were referred. When they are not busy with callers, receptionists may type, file, or operate a switchboard. Some receptionists open and sort mail and collect and distribute messages. Still others prepare travel vouchers and do simple bookkeeping.

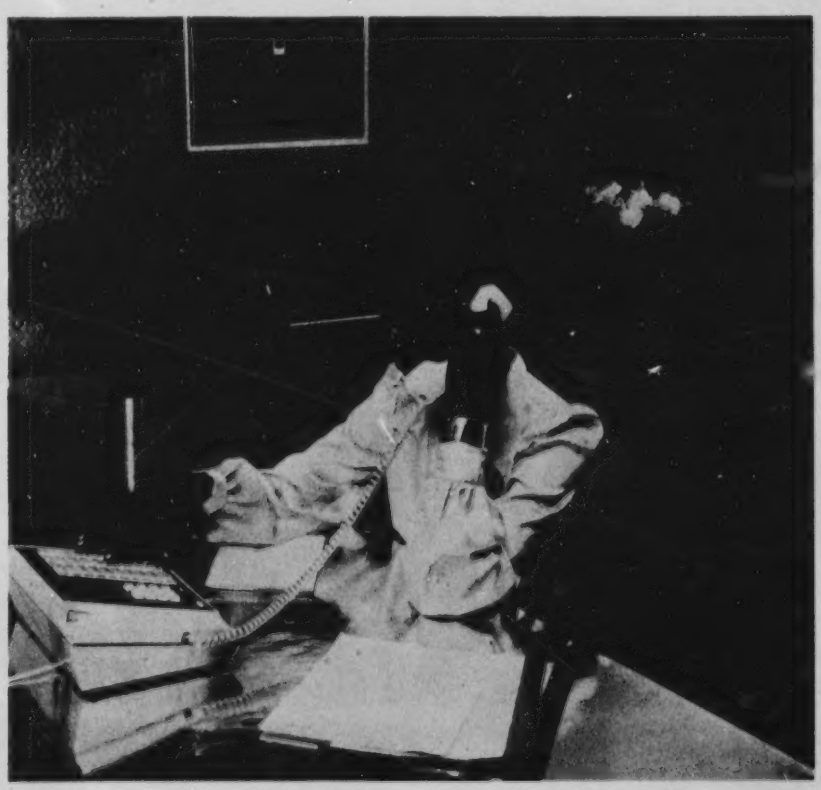
Places of Employment

About 500,000 persons worked as receptionists in 1976. Part-time employment is readily available for receptionists, and about 1 in 3 works part time.

Although receptionists work in almost every kind of organization, about half work for doctors, dentists, hospitals, and other health service providers. Large numbers of receptionists also work in insurance companies, banks, factories, and firms providing business and personal services.

Training, Other Qualifications, and Advancement

A high school diploma generally is required for work as a receptionist. Courses in English, spelling, typing,



Liking people and wanting to help them are important assets for receptionists.

elementary bookkeeping, and business practices are helpful to the beginner.

Liking people and wanting to help them are assets to the receptionist. A neat appearance, a pleasant voice, and an even disposition also are important. Because receptionists do not work under close supervision, common sense and a thorough understanding of how the business is organized help them handle various situations that arise.

Promotion opportunities for receptionists are limited, especially in small offices. In large workplaces, however, a receptionist who has clerical skills may advance to a better paying job as a secretary, administrative assistant, or bookkeeper. Many companies have their own training programs so that the skills needed for advancement can be learned on the job. College or business school training also can be helpful in advancing to better paying office jobs.

Employment Outlook

Employment of receptionists is expected to grow faster than the average for all occupations through the mid-1980's. Thousands of openings will result each year as businesses expand and as receptionists who die, retire, or transfer to other jobs are replaced. The number of replacements will be quite large because the occupation is large and turnover is high.

Within the fast-growing clerical field, receptionist employment is expected to grow rapidly. This is largely because so many receptionists work for firms providing business, personal, and professional services—a sector of the economy which is expected to show very strong growth in the future. In addition, more and more firms recognize the importance of the receptionist in promoting good public relations. Also, because the receptionist's work is of a person-to-person nature, it is unlikely to be affected by office automation.

Job opportunities should continue to be excellent for persons who do not wish to work full time. This occupation also offers many opportunities for those without prior work experience.

Earnings and Working Conditions

Full-time switchboard operator-receptionists working in urban areas averaged $141 a week in 1976. This was about three-quarters as much as the average earnings for nonsupervisory workers in private industry, except farming. Receptionists working in the western United States had average weekly earnings of $149. Those in southern cities averaged $133 a week. In the Federal Government, beginning information receptionists averaged $171 a week in 1977.

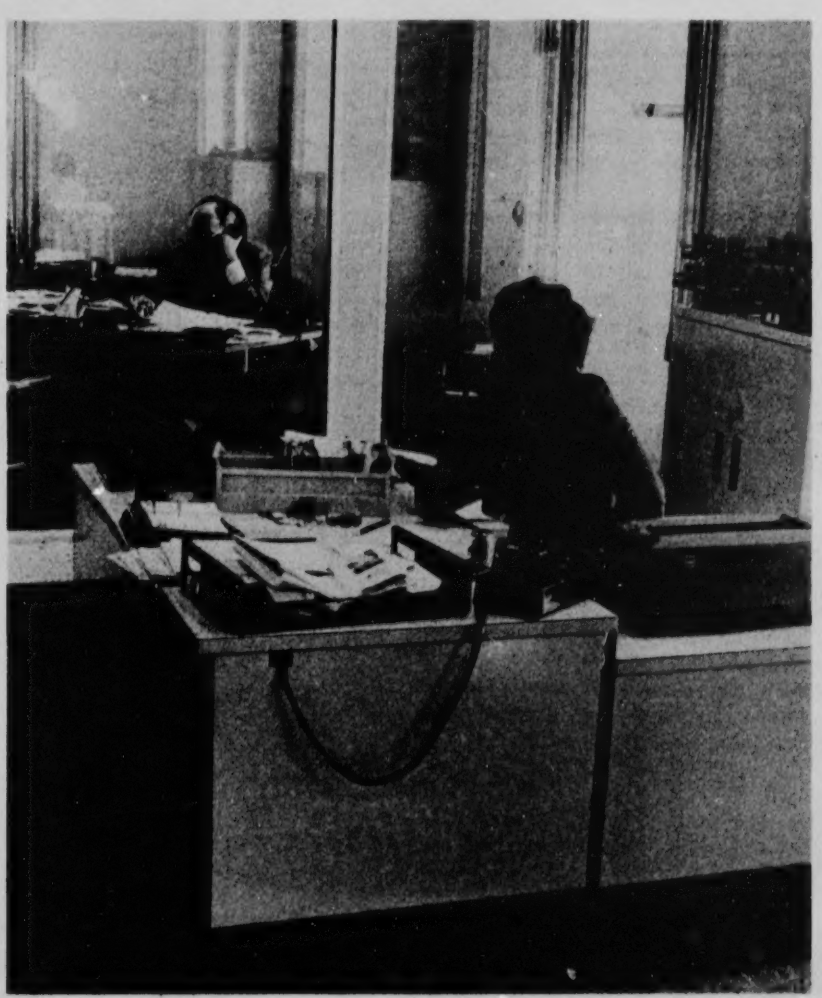
Receptionists usually work in areas that are comfortably furnished. Although most have regular hours, receptionists in hospitals and beauty shops may work evenings and weekends. (See the statement on clerical occupations for sources of additional information.)

SECRETARIES AND STENOGRAPHERS

(D.O.T. 201.268 and .368, 202.388, and 209.138)

Nature of the Work

The efficiency of any organization depends upon *secretaries* and *stenographers*, who are at the center of communications within their firm. They transmit information to the staff and to persons in other organizations.



Secretaries and stenographers are at the center of communications within their firms.

Secretaries (D.O.T. 201.368) relieve their employers of routine duties so that they can work on more important matters. Although most secretaries type, take shorthand, and deal with callers, the time spent on these duties varies in different types of organizations.

In offices where dictation and typing are handled in word processing centers, *administrative secretaries* handle all other secretarial duties. (For more information on these centers, see the statement on typists elsewhere in the *Handbook*.) They often work in clusters of three or four so that they can readily help each other. Because they are released from dictation and typing, they can serve several members of the professional staff. Their duties range from filing, routing mail, and answering telephones to more responsible jobs such as answering letters, doing statistical research, and writing reports.

Some secretaries are trained in specific skills needed in certain types of work. *Medical secretaries* prepare case histories and medical reports; *legal secretaries* do legal research and help prepare briefs; and *technical secretaries* assist engineers or scientists in drafting reports and research proposals. Another specialized secretary is the *social secretary* (D.O.T. 201.268), who arranges social functions, answers personal correspondence, and keeps the employer informed about all social activities.

Stenographers (D.O.T. 202.388) take dictation and then transcribe their notes on a typewriter. They may either take shorthand or use a stenotype machine that prints symbols as certain keys are pressed. *General stenographers*, including most beginners, take routine dictation and do other office tasks such as typing, filing, answering telephones, and operating office machines. Experienced and highly skilled stenographers take difficult dictation and do more responsible clerical work. They may sit in on staff meetings and give a summary report or a word-for-word record of the proceedings. They also supervise other stenographers, typists, and clerical workers. *Technical stenographers* must know the terms used in a particular profession. They include medical, legal, and engineering or scientific stenographers. Some experienced stenographers take dictation in foreign languages; others work as public stenographers serving traveling business people and others.

Shorthand reporters are specialized stenographers who record all statements made in a proceeding. Nearly half of all shorthand reporters work as *court reporters* attached to courts of law at different levels of government. They take down all statements made at legal proceedings and present their record as the official transcript. Many other shorthand reporters work as *free-lance reporters* who record out-of-court testimony for attorneys, meetings and conventions, and other private activities. Still others record the proceedings in the Congress of the United States, in State legislatures, and in both State and Federal agencies.

Most reporters dictate notes on magnetic tapes that a typist can transcribe later. Because the reporter's transcript is the official record of a proceeding, accuracy is vitally important.

Places of Employment

About 3.5 million persons worked in jobs requiring secretarial or stenographic skills in 1976; most were secretaries. Only about 100,000 persons worked as stenographers in 1976.

Opportunities for part-time work are increasing in these and other clerical occupations. In 1976, approximately one of every five secretaries and one in six stenographers worked part time.

Secretaries and stenographers are employed throughout the economy. About two-thirds of them, however, work in banks, insurance companies, real estate firms, government agencies, and other establishments providing services to the public. Most specialized stenographers and secretaries work for doctors, lawyers, and other professional people.

Training, Other Qualifications, and Advancement

Generally, graduation from high school is required for a job as a secretary or stenographer. Many employers prefer applicants who have additional secretarial training at a college or private business school. Courses vary from a few months' instruction in basic shorthand and typing to longer programs teaching specialized skills such as shorthand reporting or legal or medical secretarial work. Shorthand reporters generally must complete a 2-year course in a shorthand reporting school.

An increasing number of private firms and government agencies have their own training facilities where employees can upgrade their skills and broaden their knowledge of the organization. Also, many State and local governments sponsor programs to train unemployed and low-skilled workers for entry jobs as secretaries.

Fourteen States require court reporters to be a Certified Shorthand Reporter (CSR). In some of these States, reporters can be hired with the understanding that they will be certified within 1 year. Certification is administered by a board of examiners in each of the 14 States. The National Shorthand Reporters Association confers the designation Registered Professional Reporter (RPR) upon those who pass a two-part examination and participate in continuing education programs. The RPR designation is recognized as the mark of excellence in the profession.

Employers usually have no preferences among the many different shorthand methods. The most important factors in hiring and promotion are speed and accuracy. To qualify for jobs in the Federal Government—and for employment in many private firms—stenographers must be able to take dictation at 100 words per minute and type 50 to 60 words per minute. Many shorthand reporting jobs require more than 225 words of dictation per minute; shorthand reporters in the Federal Government generally must take 175 words a minute.

Secretaries and stenographers should have good hearing; a knowledge of spelling, punctuation, and grammar and a good vocabulary are essential. The ability to concentrate amid distractions is vital for shorthand reporters. Employers look for

persons who are poised and alert, and who have pleasant personalities. Discretion, judgment, and initiative are important for the more responsible secretarial positions.

Many stenographers who improve their skills advance to secretarial jobs; others who acquire the necessary speed through additional training can become shorthand reporters. Secretaries can increase their skills and broaden their knowledge of their company's operations by taking courses offered by the company or by local business schools, colleges, and universities. As secretaries gain knowledge and experience, they can qualify for the designation Certified Professional Secretary (CPS) by passing a series of exams given by the National Secretaries Association. This designation is recognized by a growing number of employers as the mark of achievement in the secretarial field. Many executive secretaries are promoted to management positions on the basis of their extensive knowledge of their employer's operations.

Employment Outlook

Employment of secretaries is expected to increase faster than the average for all occupations through the mid-1980's as the continued expansion of business and government creates a growing volume of paperwork. Hundreds of thousands of jobs will become available each year due to growth and the need to replace those who die, retire, or stop working for other reasons.

Demand for secretaries will rise mainly as those organizations that require large secretarial staffs expand their operations. New government agencies, particularly at the State and local level; insurance companies offering new forms of protection; and banks providing financial counseling for an increasingly affluent population are just a few of the organizations that will need well-trained and versatile secretaries in the years ahead. Although many new types of automatic office equipment have been introduced in recent years, no adverse impact on employment of secretaries is expected. However, jobseekers who are familiar with a wide range of office machines and procedures are likely to have better prospects than other workers.

Persons with secretarial skills should find extensive opportunities for temporary or part-time work as employers increasingly turn to these workers during peak business periods. Such arrangements may be especially attractive to students, persons with family responsibilities, retired persons, and others interested in flexible work schedules.

Employment of stenographers is expected to continue the decline of recent years. The increased use of dictation machines has severely reduced the need for office stenographers, and fewer jobs will be available than in the past. Demand for skilled shorthand reporters, in contrast to the overall outlook for stenographers, should remain strong as State and Federal court systems expand to handle the rising number of criminal court cases and civil lawsuits. Competition for entry level jobs is increasing as more students enter the field. Opportunities will be best for those who have earned certification by the National Shorthand Reporters Association.

Earnings and Working Conditions

According to a Bureau of Labor Statistics (BLS) survey, general stenographers working in urban areas averaged $706 a month in 1976; experienced workers who were highly skilled averaged $788. Shorthand reporters generally earn higher salaries than other stenographic workers. According to a survey conducted by The National Shorthand Reporters Association, shorthand reporters averaged about $15,000 a year in 1976.

According to the BLS survey, secretaries to supervisors in small offices earned monthly salaries of $741. Secretaries to officers in small companies had average monthly salaries of $804; those working for middle management in large companies averaged $868. Secretaries having greater responsibilities, such as executive secretaries to corporate officers, earned average monthly salaries of $954.

Beginning clerk-stenographers in the Federal Government earned from $548 to $775 a month in 1977 depending on education, training, and experience. Earnings of beginning shorthand reporters ranged from $864 to $1,175 a month depending on speed, education, and experience. Starting salaries for secretaries in the Federal Government ranged from $775 to $960 a month, while the average for all secretaries was $982 a month. In 1976, earnings of stenographers were slightly less and those of secretaries slightly more than average earnings for all nonsupervisory workers in private industry, except farming.

Working conditions for secretaries and stenographers generally are similar to those of other office workers in the same organization. Shorthand reporters, however, often sit for long periods of time while recording an event. (See the statement on clerical occupations for more information on earnings and working conditions.)

Sources of Additional Information

For information on careers in secretarial work, write to:

National Secretaries Association (International), 2440 Pershing Rd., Suite G10, Kansas City, Mo. 64108.

Additional information on careers in secretarial work and a directory of business schools are available from:

Association of Independent Colleges and Schools, 1730 M St. NW., Washington, D.C. 20036.

For information about shorthand reporting, contact:

National Shorthand Reporters Association, 2361 South Jefferson Davis Hwy., Arlington, Va. 22202.

SHIPPING AND RECEIVING CLERKS

(D.O.T. 209.688, 219.388, 222.138 through .687, 223.387, 239.588, 910.368 and 920.887)

Nature of the Work

Shipping and receiving clerks keep track of goods transferred between businesses and their customers and suppliers. In small companies, one

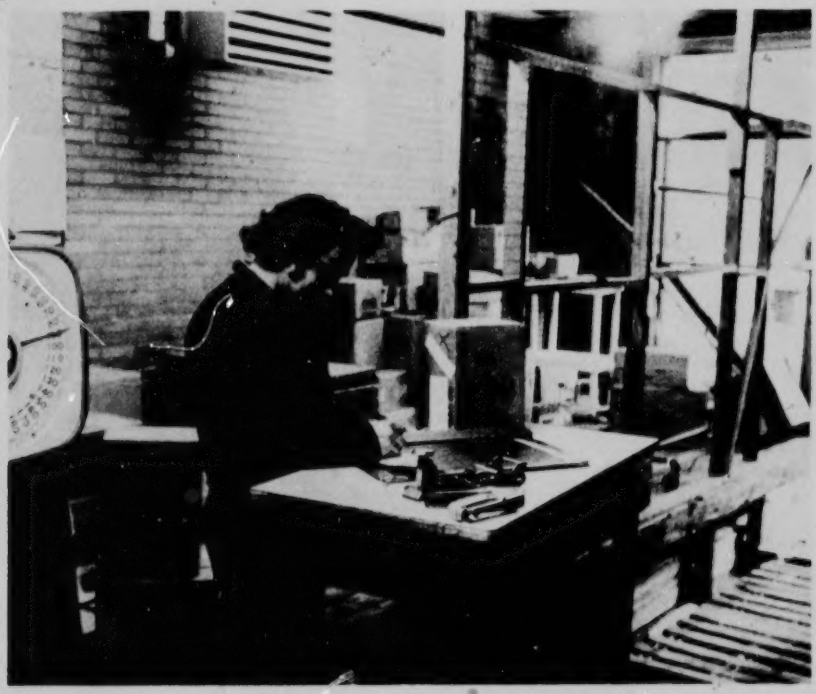
clerk may keep records of all shipments sent out and received; in larger companies, many clerks take care of this recordkeeping.

Shipping clerks are responsible for all shipments leaving a business place. Before goods are sent to a customer, these clerks check to be sure the order has been filled correctly. Some shipping clerks fill orders themselves. They obtain merchandise from the stockroom and wrap it or pack it in shipping containers. Clerks also put addresses and other identifying information on packages, look up and compute either freight or postal rates, and record the weight and cost of each shipment. They also may prepare invoices and furnish information about shipments to other parts of the company, such as the accounting department. Once a shipment is checked and ready to go, shipping clerks may move it to the shipping dock and direct its loading on trucks according to its destination. Shipping and receiving clerks working in small businesses may combine these tasks with the various duties of stock clerks. (For more information about the additional duties of shipping clerks in small firms, see the statement on stock clerks elsewhere in the *Handbook*.)

When shipments arrive, receiving clerks perform tasks similar to those of shipping clerks. They determine whether their employer's orders have been correctly filled by verifying incoming shipments against the original order and the accompanying bill of lading or invoice. They record the receipt and condition of incoming shipments. Clerks also make adjustments with shippers for lost and damaged merchandise. Routing or moving shipments to the proper department, warehouse section, or stockroom and providing information that is needed to compute inventories also may be part of their job.

Places of Employment

About 440,000 persons worked as shipping and receiving clerks in 1976. More than half worked in factories; large numbers also were employed by wholesale houses or retail stores. Although jobs for shipping and receiving clerks are found in all localities, most clerks work in urban areas, where many factories and wholesale houses are located.



Receiving clerk carefully checks manifest.

Training, Other Qualifications, and Advancement

High school graduates are preferred for beginning jobs in shipping and receiving departments. Business arithmetic, typing, and other high school business subjects are helpful. The ability to write legibly is important. Dependability and an interest in learning about the firm's products and business activities also are qualities that employers seek. In addition, shipping and receiving clerks should be able to work under close supervision at repetitive tasks.

New employees usually are trained on the job by an experienced worker. As part of their training they often file, check addresses, attach labels, and check items included in shipments. As clerks gain experience, they may be assigned tasks requiring a good deal of independent judgment, such as handling problems of damaged merchandise, or supervising other workers in shipping or receiving rooms.

A job as a shipping or receiving clerk offers a good opportunity for new workers in a firm to learn about their company's products and business practices. Some clerks may be promoted to head shipping or receiving clerk or warehouse manager. Others may enter related fields such as industrial traffic management or purchasing. (Industrial traffic managers and purchasing agents are discussed elsewhere in the *Handbook*.)

Employment Outlook

Employment of shipping and receiving clerks is expected to rise about as fast as the average for all occupations through the mid-1980's as business expands and there are more goods to be distributed. Several thousand jobs will become available each year as employment grows and as workers retire, die, or transfer to other occupations.

Although substantial growth is expected in the volume of goods to be moved, employment of shipping and receiving clerks will not increase as rapidly because of changes in technology that enable fewer clerks to handle more goods. Growing numbers of firms are using computers to keep track of shipping and receiving

records, and moving belts to handle shipments once lifted by hand.

Earnings and Working Conditions

Shipping and receiving clerks in urban areas averaged $200 a week, according to a 1976 survey. This is about as much as the average earnings for all nonsupervisory workers in private industry, except farming. Salaries varied substantially, however, by type of employer. Shipping and receiving clerks employed by manufacturing firms averaged $200, those working for wholesale houses averaged $210, and those employed by public utilities averaged $248.

Most shipping and receiving clerks receive time-and-a-half for work over 40 hours. Night work and overtime, including work on Saturdays, Sundays, and holidays, may be necessary when shipments have been unduly delayed or when materials are needed immediately on production lines. Although shipping and receiving clerks do much of their work in warehouses or in shipping and receiving rooms, they may do some of it on outside loading platforms. Workplaces often are large, unpartitioned areas that may be drafty, cold, and littered with packing materials.

Most clerks must stand for long periods while they check merchandise. Locating numbers and descriptions on cartons often requires a great deal of bending, stooping, and stretching. Also, under the pressure of getting shipments moved on time, clerks sometimes may help load or unload materials in the warehouse. (See the statement on clerical occupations for additional information on fringe benefits.)

Sources of Additional Information

Information about the work and earnings of shipping and receiving clerks in wholesale establishments is available from:

National Association of Wholesaler-Distributors, 1725 K St. NW., Washington, D.C. 20006.

STATISTICAL CLERKS

(D.O.T. 205.368, 206.588, 209.388, 219.388, .488, and .588, 222.687, 223.588, 913.368, and 953.168)

Nature of the Work

Administrators and managers in all types of organizations depend on numerical records to help make decisions. Statistical clerks prepare and insure the accuracy and completeness of these records. Although the occupational title "statistical clerk" covers a number of different jobs performed by statistical workers, the jobs in this field can be grouped into four categories: recording, compiling and coding, computing and tabulating, and scheduling.

Recording. This work involves collecting and verifying the accuracy of information. *Shipping checkers* (D.O.T. 222.687) in manufacturing companies and wholesale and retail businesses insure that merchandise to be shipped is properly labeled and contains the desired number of items. *Car checkers* (D.O.T. 209.588) keep records of shipments as they arrive at or leave a railroad freight terminal. They check the number of railroad cars and verify their contents with the specifications on the invoice. *Counters* (D.O.T. 223.588), who may have a title specifying their work or the items that they count, record the number of materials received, transferred, or produced. For example, lumber talliers or lumber checkers record the amount and type of lumber processed in sawmills; pit recorders collect production data in the steel industry.

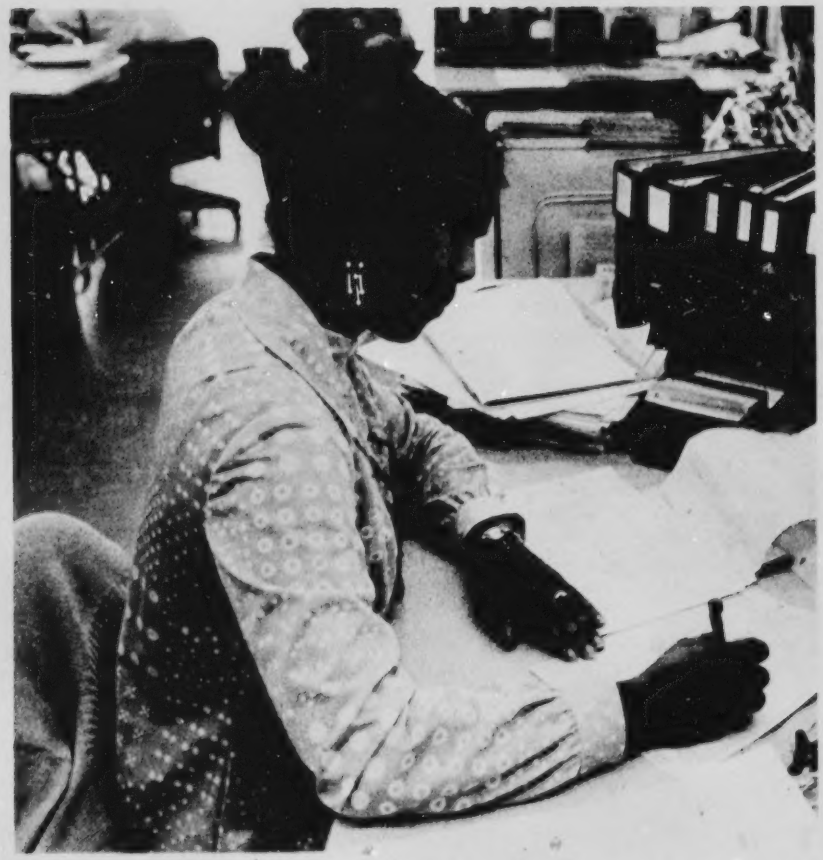
Compiling and coding. In organizations of all types, information must be properly filed, verified, or analyzed for data processing. *Posting clerks* (D.O.T. 219.588) do this work by making entries in registers and journals. They receive and sort records of shipments, production, and financial transactions to provide company officials with current information on business activities. *Record keepers* (D.O.T. 206.588), also known as classification clerks, record data systematically for easy location. *Coding clerks* (D.O.T. 219.388) convert information obtained from records and reports into computer codes for data processing. *Personnel clerks* (D.O.T. 205.368) gather and file information on the employees of a business; their work may include some typing and preparation of reports.

Computing and tabulating. Organizations frequently use numerical records for reports and research. Statistical clerks gather information from records to present in a chart or table for analysis. *Actuary clerks* (D.O.T. 219.388) use certain formulas, statistical charts, and insurance rate books to assist actuaries in determining insurance rates for company customers. They also prepare charts and tables for studies on general insurance practices. *Policy checkers* (D.O.T. 219.488) verify the accuracy of insurance company records. *Statistical assistants* (D.O.T. 219.388), also known as tabulating clerks, calculate and compute numerical data on the population and its characteristics for government and business research projects. *Demurrage clerks* (D.O.T. 219.388), employed by railroads, use rate tables to compute railway freight charges and calculate the weight of shipments or distance railroad cars have traveled.

Scheduling. Statistical clerks may schedule business activities that involve the movement of people and things. Through planning, they assure that these activities run smoothly and efficiently. For example, *assignment clerks* (D.O.T. 913.368) work for bus companies and assign drivers to meet riders' transportation needs. Drivers are selected on the basis of experience, seniority, and nature of the assignment. *Crew schedulers* (D.O.T. 219.388) do similar work for airlines; they assign pilots to scheduled flights and log the mileage each pilot has flown. *Gas dispatchers* (D.O.T. 953.168) determine the proper pressure in a natural gasline to meet customers' requirements after considering information such as the weather, time of day, and other factors that affect the use of gas.

Places of Employment

About 337,000 persons worked as statistical clerks in 1976. Although



Statistical clerks compile the numerical records often used by management to make decisions.

statistical clerks are employed in nearly every industry, over half worked in finance, insurance, and real estate companies; manufacturing firms; and Federal, State, and local government.

Because businesses of almost every size require numerical records, statistical clerks work throughout the United States. Jobs are concentrated, however, in heavily populated cities that are centers of industry and government activities.

Training, Other Qualifications, and Advancement

Most employers prefer to hire high school graduates for statistical clerk jobs. They also seek applicants who have an aptitude for working with numbers and the ability to do detailed work. High school students may prepare for jobs as statistical clerks by taking courses in general mathematics, algebra, and geometry. Also recommended are courses in data processing, office procedures, bookkeeping, and typing.

In many companies, general clerks who have become familiar with their employers' record systems and office procedures are promoted to statistical clerk positions. On-the-job training that equips the employee to specialize in numerical work may include the use of calculators, tabulating machines, and typewriters.

Statistical clerks must be familiar with the items or information which they observe and record. For example, lumber checkers must know the various types and qualities of wood products. In preparing data for processing, coding clerks must use the proper computer codes to avoid errors.

Statistical clerks should be able to do prompt and accurate work under close supervision. Also, they should be tactful and even tempered when working with others in the same office.

Most employers follow a promotion-from-within policy that allows experienced workers to qualify for more responsible jobs as they become available. Qualified statistical clerks may perform more difficult assignments or advance to supervisory positions. Some statistical clerks are able to advance to a technician level where they may deal with the technical problems of statistical research projects. Some clerks become computer programmers.

Employment Outlook

Employment of statistical clerks is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to job opportunities arising from this growth, many additional openings will occur as clerks die, retire, or leave the occupation for other reasons.

This occupation includes a wide range of jobs, and the prospects for statistical clerks are better in certain areas than in others. Some routine jobs, for example, may be eliminated as computers are increasingly used to collect and process information. However, statistical clerks in jobs such as those that require personal contact or involve the preparation of data for computer analysis are expected to be in great demand.

Among the factors that will contribute to the demand for statistical clerks is the expected increase in business and government activities, including projects requiring the collection and processing of large amounts of numerical data. In addition, administrators increasingly will rely on numerical records to analyze and control all aspects of their organization's work.

Earnings and Working Conditions

Limited information indicates that beginning statistical clerks earn about as much as workers in other entry level clerical jobs such as office clerks or file clerks; salaries for these workers ranged between $110 and $130 a week in 1976. The entrance salary for beginning statistical assis-

tants employed by the Federal Government was $142 a week in 1977.

Most experienced workers doing statistically related clerical work, including the operation of tabulating machines or calculators, earned between $155 and $200 a week in 1976. Top level clerks and supervisors averaged about $235 a week. Earnings usually are highest in manufacturing, transportation, and utilities industries; they are lower in retail trade, finance, insurance, and real estate, and service industries.

Nearly every employer of statistical clerks offers some form of health plan, life insurance coverage, and retirement benefits. Most statistical clerks work in clean, well-lighted and well-ventilated offices. (See the statement on clerical occupations for sources of additional information.)

STOCK CLERKS

(D.O.T. 223.138, .368, .387, .388, .588, .687; 910.388; 969.387)

Nature of the Work

Most employers recognize the importance of keeping well-balanced inventories to prevent sales losses or slowdowns in production.

Stock clerks (D.O.T. 223.387) help protect against such losses by controlling the flow of goods received, stored, and issued. They usually receive and unpack incoming merchandise or material. They report damaged or spoiled goods and process papers necessary for obtaining replacements or credit. On outgoing orders, they may check the items for quality and quantity and sometimes make minor repairs or adjustments.

Materials are stored in bins, on the floor, or on shelves according to the plan of the stockroom. Stock clerks organize and mark items with identifying codes or prices so that inventories can be located quickly and easily. They keep records of items entering or leaving the stockroom. Sometimes they label, pack, crate, or address goods for delivery.

Stock clerks working in small firms also may perform various duties usually handled by shipping and receiving clerks. (For more information about the additional duties of stock clerks in small firms, see the statement on shipping and receiving clerks elsewhere in the *Handbook*.) In large firms with specialized jobs, *inventory clerks* (D.O.T. 223.388) periodically count items on hand and make reports showing stock balances. *Procurement clerks* (D.O.T. 223.368) work in factories and prepare orders for the purchase of new equipment.

The duties of stock clerks also depend on the items they handle. For example, stock clerks who work with food and drugs must maintain proper temperature and humidity conditions to prevent spoilage; those who handle construction items such as lumber and bricks must do much walking and climbing to note the condition and quantity of that stock.

Places of Employment

About 490,000 persons worked as stock clerks in 1976. About three-fourths of them worked in factories, wholesale firms, and retail stores. Many others were employed by airlines, government agencies, hospitals, and other organizations that keep large quantities of goods on hand. Although jobs for stock clerks are found in all parts of the country, most work in urban areas where factories, warehouses, and stores are concentrated.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements for beginning stock clerks, employers prefer high school graduates. Reading and writing skills and a basic knowledge of mathematics are necessary; typing and filing abilities also are useful. Good health, especially good eyesight, is important. Generally, those who handle jewelry, liquor, or drugs must be bonded.

Stock clerks usually receive on-the-job training. New workers begin with simple tasks such as counting and marking stock. Basic responsibilities of the job usually are learned within several weeks. As they prog-

Some competition is likely for stock clerk positions because many young people seek this work as a first job.

ress, stock clerks learn to keep records of incoming and outgoing materials, take inventories, and order supplies. In small firms, stock clerks may advance to sales positions or become assistant buyers or purchasing agents. In large firms, stock clerks can advance to more responsible stock handling jobs such as invoice clerk, stock control clerk, or procurement clerk. A few may be promoted to stockroom supervisor, but additional education often is required.

Employment Outlook

Employment of stock clerks is expected to increase about as fast as the average for all occupations through the mid-1980's. Many thousands of job openings will occur each year as employment grows and as workers die, retire, or transfer to other occupations.

Growth in employment of stock clerks probably will be slower than in the past as computers are used increasingly for inventory control. Because entrance into this occupation is relatively easy and many young people seek this work as a first job, some competition for openings is likely.

Earnings and Working Conditions

Experienced stock clerks earned average weekly salaries of $192 in 1976, according to the limited data available. This was slightly above the average for nonsupervisory workers in private industry, except farming.

In the Federal Government, beginning stock clerks without experience were paid $126 a week in late 1976; those with general work experience received $142 a week. Experienced stock clerks in the Federal Government averaged about $203 a week in 1976.

Stock clerks generally receive time-and-one-half for work over 40 hours. Overtime may be required when large shipments are delivered and when inventory is taken.

Although stock clerks usually work in relatively clean, heated, and well-lighted areas, some stockrooms may be damp and drafty. Clerks handling refrigerated goods may spend some time in cold storage rooms. Stock clerks are on their feet much of the working day, often on a concrete floor. The job also involves considerable bending, lifting, and climbing. (See the statement on clerical occupations for additional information on working conditions and fringe benefits.)

Sources of Additional Information

Information about the work and earnings of stock clerks in wholesale establishments is available from:

National Association of Wholesaler-Distributors, 1725 K St. NW., Washington, D.C. 20006.

TYPISTS

(D.O.T. 203.138 through .588; 208.588; and 209.382 through .588)

Nature of the Work

A rapid flow of written communication is essential to the modern office. The typist helps to maintain this flow by making neat, typed copies of handwritten, printed, and recorded words.

Beginning or *junior typists* usually type headings on form letters, copy directly from handwritten drafts, and address envelopes. Often, they do other office tasks, including answering telephones, filing, and operating office machines such as copiers and calculators.

More experienced typists do work that requires a high degree of accuracy and independent judgment. *Senior typists* work from rough drafts which are difficult to read or which contain technical material. They may plan and type complicated statistical tables, combine and rearrange materials from different sources, or prepare master copies to be reproduced on copying machines.

Clerk typists (D.O.T. 209.388) combine typing with filing, sorting mail, answering telephones, and other general office work. *Varitypists* (D.O.T. 203.582) produce master copies, such as stencils, on machines similar to typewriters.

Transcribing machine operators (D.O.T. 208.588) type letters and reports as they listen to dictation recorded on magnetic tape. Other typists who have special duties include *policy writers* (D.O.T. 203.588) in insurance companies, *waybill clerks* (D.O.T. 209.588) in railroad offices, and *mortgage clerks* (D.O.T. 203.588) who work in banks.

In some offices, many typists are grouped in a specialized word processing center that handles all the transcription and typing for several departments. These workers, usually called *correspondence secretaries*, operate various kinds of high-speed typewriters equipped with a programmed memory which enables them to produce final copy with a minimum of retyping.

Places of Employment

About 1 million persons worked as typists in 1976. In addition, many other workers—including secretaries, newspaper reporters, writers, and editors—use typing skills in the performance of their jobs.

Part-time employment is readily available for workers with clerical skills, and nearly one typist out of four works part time. Typists are employed throughout the entire economy. Over half of them work in factories, banks, insurance companies, real estate firms, and government agencies.

Training, Other Qualifications, and Advancement

Typists generally need a high school diploma. Good spelling, punctuation, and grammar are essential. Ability to operate office equipment, such as copying and adding machines, and also a knowledge of office procedures, are assets.

An increasing number of companies and government organizations have their own typist training programs. These give employees a chance to learn or upgrade skills so that they can advance to more responsible positions within the organization. Many States and localities sponsor programs to train unemployed and low-skilled workers for entry jobs as typists.

Nearly 1 out of 4 typists works part time.

Many employers require applicants for typing jobs to take a test that shows their speed and accuracy. For most jobs, a speed of 50 to 60 words per minute is required. All typists who transcribe recorded dictation need sharp hearing and must be especially good in spelling. Successful typists are neat, accurate, and able to concentrate amid distractions.

As beginners increase their skills, they often advance to higher level typing jobs. Some typists are promoted to supervisor jobs in word processing centers. Others who master additional skills can move into secretarial jobs.

Employment Outlook

The number of typists is expected to grow about as fast as the average for all occupations through the mid-1980's as business expansion increases the volume of paperwork. Many job openings will occur every year because turnover in this occupation is very high. Jobs for typists also will become available as employment continues to grow.

Continued growth of the economy, particularly those industries that generate vast quantities of written records and correspondence, will assure very good prospects for typists in the years ahead. Demand should be particularly strong for highly skilled workers and those who can handle other office jobs in addition to typing. Many employers will prefer typists who are familiar with new kinds of word processing equipment. Because an increasing number of employers are using temporary and part-time workers during peak business periods, opportunities should continue to be excellent for typists who do not wish to work full time.

Earnings and Working Conditions

According to a recent survey, beginning typists averaged $142 a week in 1976. Those with experience earned $166 a week, slightly less than the average earnings for nonsupervisory workers in private industry, except farming.

In the Federal Government, the starting salary for typists without experience was $126 a week in 1977, compared with $160 a week for those with experience. Average weekly earnings for all typists in the Federal Government were $157.

Working conditions for typists usually are similar to those for other office employees. Typists, like other clerical workers, sit for periods of time and often must contend with high noise levels caused by office machines located nearby. (See the statement on clerical occupations for more information on working conditions and also for a list of places to write for additional information on clerical jobs.)

COMPUTER AND RELATED OCCUPATIONS

Since 1951 when the first computer was installed for commercial use, computer systems have become an increasingly important part of everyday life. Today these machines bill customers, pay employees, record airline and hotel reservations, and monitor factory production processes. Scientific and engineering research relies on computer systems to solve complex equations as well as to collect, store, and sort vast amounts of data.

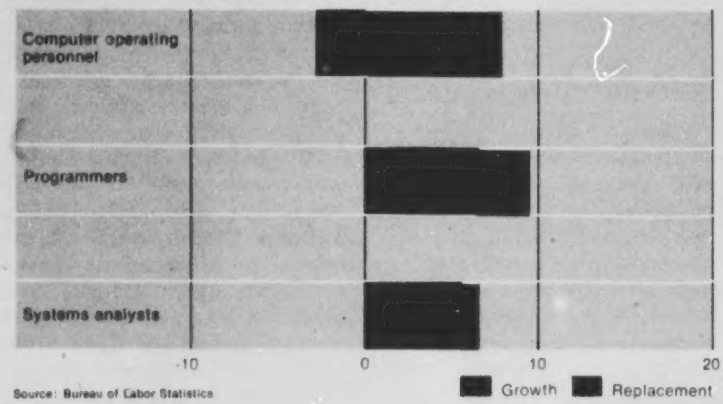
Workers in computer and related occupations design systems for processing information, write instructions and translate them into machine-readable language, and operate computers and peripheral equipment.

Most computer careers require some type of specialized training. Although not a universal requirement, a college degree is increasingly important for systems analysts and programmers—especially for those working in scientific and technical research operations. Computer operators usually need a high school diploma, but specialized training and experience are more important than formal education. For all computer occupations, employers stress the importance of learning on the job.

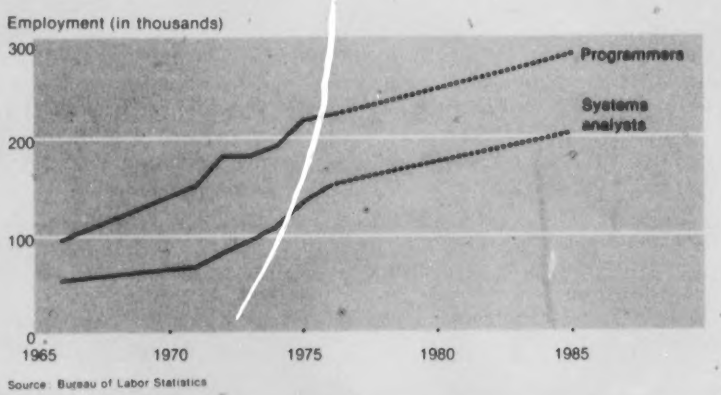
In addition to technical knowledge and skills, computer personnel must be able to concentrate on their work and should enjoy working with details. Those who operate equipment—keypunchers or console operators, for example—must have manual dexterity and some mechanical aptitude. Programmers and systems analysts must be able to think logically and should enjoy solving problems.

This chapter describes three computer occupations: Computer Operating Personnel, Programmers, and Systems Analysts.

Most openings for programmers and systems analysts will result from growth



Employment of programmers and systems analysts, negligible in 1960, is expected to grow to half a million workers by 1985



COMPUTER OPERATING PERSONNEL

(D.O.T. 213.138, .382, .582, .588, and .885, and 223.387)

Nature of the Work

All data systems require specialized workers to enter data and instructions, operate the computer, and retrieve the results. The data to

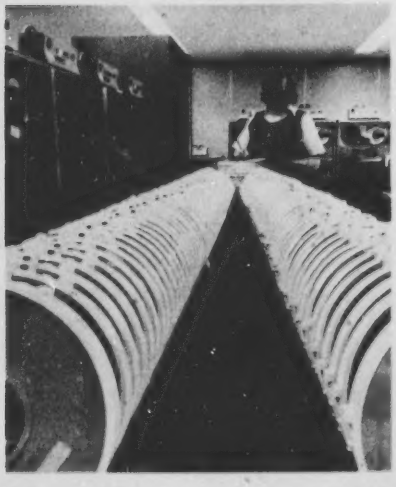
be processed and the instructions for the computer are called "input;" the results are called "output."

Information is entered into a computer system in a variety of ways. In many systems, *keypunch operators* (D.O.T. 213.582) prepare input by punching patterns of holes in cards to represent different letters, numbers, and special characters, using a machine similar to a typewriter. In others, *data typists* (D.O.T. 213.588) use special machines that convert the information they type to holes in cards or magnetic impulses on tapes or disks. Many newer systems are capable of remote data entry. The user sits at a machine equipped with a typewriter keyboard and an electronic screen that displays the data as it is entered directly into the computer.

Once the input is coded, prepared in a form the computer can read, it is ready to be processed. *Console operators* (D.O.T. 213.382) examine the programmer's instructions for processing the input, make sure the computer has been loaded with the correct cards, magnetic tapes, or disks and then start the computer. While it is running, they watch the machine, paying special attention to the error lights that could signal a malfunction. If the computer stops or one of the lights goes on, operators must locate the problem and remove the faulty input materials.

In some systems, machines directly connected to the computer translate output into the form desired by the programmer. In others, high-speed printers or converters run by auxiliary equipment operators—*high-speed printer operators* (D.O.T. 213.382) and *converter operators* (D.O.T. 213.382)—perform this function.

Frequently, data on punched cards, magnetic tape, or disks are kept for future use. *Tape librarians* (D.O.T. 223.387) classify and catalog this material and maintain files of current and previous versions of programs, listings, and test data. In smaller organizations, librarians may do some keypunching as well as coordinate activities between the programmer and the operations department.



Some operators work evenings or night shifts because computers are used 24 hours a day.

Places of Employment

About 565,000 persons worked as console, auxiliary equipment, and keypunch operators in 1976.

Although workers in these occupations are employed in almost every industry, most work in manufacturing firms, wholesale and retail trade establishments, banks, and government agencies. Many computer and peripheral equipment operators work for insurance companies and firms that provide data processing services for a fee.

Training, Other Qualifications, and Advancement

In firms that have just installed a new computer system, tabulating and bookkeeping machine operators may be transferred to jobs as keypunch or auxiliary equipment operators, or console operators. Most often, however, employers recruit workers from the outside. Some organizations train typists to operate keypunch machines, but most seek workers who already have this skill. Many high schools, public and private vocational schools, private computer schools, and business schools and colleges offer training in computer operating skills. Young men and women in military service also can learn valuable skills in computer operations. In addition, a growing number of business firms across the country hold weekend seminars on data processing for high school students.

Employers in private industry usually require applicants to have a high school education, and many prefer console operators to have some college training, especially in data processing. The Federal Government requires a high school diploma, unless applicants have had specialized training or experience. Many employers test applicants to determine their aptitude for computer work, particularly their ability to reason logically. Keypunch operators and other data entry personnel often are tested for their ability to work quickly and accurately.

Beginners usually are trained on the job. The length of training needed varies—auxiliary equipment operators can learn their jobs in a few weeks, but console operators require several months of training because they must become sufficiently familiar with the computer equipment to be able to trace the causes of failures.

Keypunch and auxiliary equipment operators should be able to work under close supervision as part of a team. They also must like working with machines and not become easily bored by repetitious tasks. Console operators must be capable of independent judgment, especially when working without supervision on second and third shifts.

Although advancement opportunities for keypunch and auxiliary equipment operators are limited, promotion to a supervisory position is possible after several years on the job. With additional training, often including college study, a few advance to jobs as console operators.

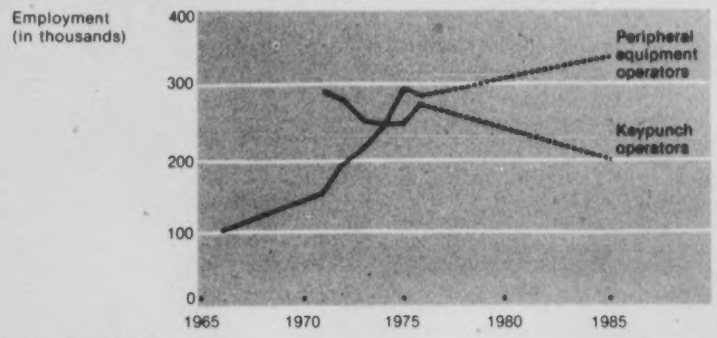
Console operators also may be promoted to supervisory positions, or to jobs that combine supervision and console operation. Through on-the-job-experience and additional training, some console operators advance to jobs as programmers.

Employment Outlook

Changes in data processing technology will have differing effects on computer operating occupations over the next decade. Employment of console and peripheral equipment operators is expected to rise about as fast as the average for all occupations while employment of keypunch operators should continue the decline

The discovery of new ways to prepare and enter data into computers has contributed to the growing need for peripheral equipment operators, but has caused demand for keypunch operators to decline

Advances in technology create some jobs and eliminate others



Source: Bureau of Labor Statistics

of recent years. Recent advances in miniaturizing circuits have enabled manufacturers to reduce both the size and the cost of computer components. As this technology develops, a continued expansion in the use of computers is expected, especially by small businesses. Employment of console and peripheral equipment operators in data processing service firms may grow less rapidly than in the past as more small firms install their own computer systems, but overall demand for these workers should remain strong.

This same technology will further reduce demand for keypunch operators. The primary reason for this decline is the increased use of computer terminals. As direct data entry techniques become more efficient, the importance of punched cards as a form of input will diminish. Despite the anticipated decline in employment, several thousand openings will occur each year as workers die, retire, or transfer out of the occupation.

Earnings and Working Conditions

Average weekly earnings of keypunch operator trainees in private industry ranged from $120 to $140 in 1976, according to surveys conducted in urban areas by the Bureau of Labor Statistics and firms engaged in research on data processing occupations. Lead operators earned from $150 to $180 weekly.

Average weekly earnings of beginning console operators averaged about $150. Experienced workers earned from $205 to $215, and lead operators earned from $230 to $260 weekly. The average weekly earnings for tape librarians in 1976 was $160.

In the Federal Government, console operators and keypunch operators without work experience started at $126 a week, and the average weekly salary was $245 for console operators and $160 for keypunch operators. Throughout the economy in 1976, console operators earned slightly more and keypunch operators earned slightly less than average earnings for all nonsupervisory workers in private industry, except farming.

Because electronic computers must be operated at carefully controlled temperatures, operators work in air-conditioned rooms. One disadvantage, however, is the high noise level generated by some auxiliary equipment. Some console and auxiliary equipment operators work evening or night shifts because many organizations use their computer 24 hours a day. Tape librarians usually work only day shifts.

Sources of Additional Information

Further information on data processing careers is available from:

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645.

PROGRAMMERS

(D.O.T. 020.188)

Nature of the Work

Computers can process masses of information rapidly and accurately, but only if they are given step-by-step instructions to follow. Because the machines cannot think for themselves, computer programmers must write detailed instructions called programs that list in a logical order the steps the machine must follow to solve a problem.

Programmers usually work from problem descriptions prepared by systems analysts who have examined the problem and determined the steps necessary to achieve the desired results. (Systems analysts are described elsewhere in the *Handbook*.) In organizations that do not employ systems analysts, workers called programmer-analysts may be responsible for both systems analysis and programming. Once this analysis has been completed, a specialist called an applications programmer writes detailed instructions for processing the data, using one of the languages developed especially for computers.

Programs vary with the type of problem to be solved. For example, the mathematical calculations involved in payroll accounting procedures are different from those required to determine the flight path of a space probe. A business applications programmer developing instructions for billing customers would first decide what company records the computer would need and then draw a flow chart or diagram showing the steps the computer must follow to obtain old balances, add new charges, calculate finance charges, and deduct payments before

Computer programmers write instructions that list the steps the computer must take to solve a problem.

determining a customer's bill. Using the flow chart, the programmer codes the actual instructions the computer will follow.

The programmer then checks the operation of the program to be sure the instructions are correct and will produce the desired information. This check is called "debugging." The programmer tries a sample of the data with the program and reviews the results to see if any errors are made. If errors occur, the program must be changed and rechecked until it produces the correct results.

Finally, an instruction sheet is prepared for the computer operator who will run the program. (The work of computer operators is described in the statement on Computer Operating Personnel.)

Although simple programs can be written in a few days, programs that use complex mathematical formulas or many data files may require more than a year of work. In such cases, several programmers may work together under an experienced programmer's supervision.

Applications programmers usually specialize in either business or scientific operations. A different type of specialist, the systems programmer, maintains the general instructions (called software) that control the operation of the entire computer system. These workers make changes in these sets of instructions that determine how the computer's resources are to be allotted among the various jobs it has been given. Because of their knowledge of operating systems, systems programmers often help applications programmers determine the source of problems with their programs.

Places of Employment

In 1976, about 230,000 persons worked as computer programmers. Most were employed by manufacturing firms, banks and insurance companies, data processing service organizations, and government agencies.

Programmers usually work in large firms that need and can afford extensive computer systems. Small firms generally require computers only for payroll or billing purposes and frequently pay data processing service organizations to do this work. Systems programmers usually work in research organizations, computer manufacturing firms, and large computer centers.

Training, Other Qualifications, and Advancement

There are no universal training requirements for progammers because employers' needs vary. Most programmers are college graduates; others have taken special courses in computer programming to supplement their experience in fields such as accounting or inventory control.

Employers using computers for scientific or engineering applications prefer college graduates with degrees in computer science, mathematics, engineering, or the physical sciences. Graduate degrees are required for some jobs. Very few scientific organizations are interested in applicants with no college training.

Although some employers who use computers for business applications do not require college degrees, they prefer applicants who have had college courses in data processing, accounting, and business administra-

tion. Occasionally, workers who are experienced in computer operation or payroll accounting but have no college training are promoted to programming jobs; however, they need additional data processing courses to become fully qualified programmers. Prior work experience is not essential for a job as a programmer; in fact, about half of all entrants to the occupation have no significant work experience.

Computer programming is taught at public and private vocational schools, colleges, and universities. Instruction ranges from introductory home study courses to advanced courses at the graduate level. High schools in many parts of the country also offer courses in computer programming.

In hiring programmers, employers look for people who can think logically and are capable of exacting analytical work. The job calls for patience, persistence, and the ability to work with extreme accuracy even under pressure. Ingenuity and imagination are particularly important when programmers must find new ways to solve a problem.

Beginning applications programmers usually spend their first weeks on the job attending training classes. After this initial instruction, they work on simple assignments while completing further specialized training programs. Programmers generally must spend at least several months working under close supervision before they can handle all aspects of their job. Because of rapidly changing technology, programmers must continue their training by taking courses offered by their employer and software vendors. For skilled workers, the prospects for further advancement are good. In large organizations, they may be promoted to lead programmers and be given supervisory responsibilties. Some applications programmers advance to systems programming. Both applications programmers and systems programmers often are promoted to the more demanding occupation of systems analyst.

Employment Outlook

Employment of programmers is expected to grow faster than the average for all occupations through the mid-1980's as computer usage expands, particularly in firms providing accounting and business management services and organizations involved in research and development. In addition to job openings resulting from growth of the occupation, several thousand openings will arise each year from the need to replace workers who leave the occupation. Because many programmers are relatively young, few openings will result from deaths or retirements. However, many vacancies will be created as experienced workers transfer into jobs as systems analysts.

The demand for applications programmers will increase as many processes once done by hand are automated, but employment will not grow as rapidly as in the past for several reasons. Improved software, such as utility programs that can be used by other than data processing personnel will simplify or eliminate some programming tasks. Also, employment of programmers in data processing firms is not expected to rise as fast as in recent years. Technology has reduced both the size and cost of computer hardware, bringing a computer system within reach of small businesses. As more small firms install their own computer, rather than rely on a data processing firm, employment growth in these data processing firms may slow somewhat. Demand throughout the economy, however, should remain strong over the next decade. Prospects should be brightest for college graduates who have had computer-related courses, particularly for those with a major in computer science or a related field. Graduates of 2-year programs in data processing technologies also should find ample opportunities, although generally limited to business applications.

Earnings and Working Conditions

Average weekly earnings of programmer trainees in private industry ranged from $190 to $200 in 1976, according to surveys conducted in urban areas by the Bureau of Labor Statistics and firms engaged in research on data processing occupations. Systems programmers generally earn more than applications programmers. For example, experienced systems programmers averaged about $360 a week compared to $310 for applications programmers. Average salaries for lead programmers were $385 and $355, respectively. In general, programmers earn about twice as much as average earnings of all nonsupervisory workers in private industry, except farming.

In the Federal Civil Service, the entrance salary for persons with a college degree was about $180 a week in 1977. Salaries for Federal Government programmers at all levels are generally comparable to those in private industry.

Programmers working in the North and West earned somewhat more than those working in the South. Those working for data processing services and public utilities had higher earnings than programmers employed in banks, advertising, or educational institutions.

Programmers work about 40 hours a week, but their hours are not always from 9 to 5. Once or twice a week a programmer may report early or work late to use the computer when it is available. Occasionally, they work on weekends or are telephoned to advise computer operators working a second or third shift.

Sources of Additional Information

Additional information about the occupation of programmer is available from:

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645.

Association for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036.

SYSTEMS ANALYSTS

(D.O.T. 003.187, 012.168, 020.081 and 020.088)

Nature of the Work

Many essential business functions and scientific research projects depend on systems analysts to plan effi-

System analysts devising a new system.

cient methods of processing data and handling the results. Analysts begin an assignment by discussing the data processing problem with managers or specialists to determine the exact nature of the problem and to bre4akit down into its component p4artsIf a new inventory system is desired, for example, systems analysts must determine what new data need to be collected, the equipment needed for computation, and the steps to be followed in processing the information.

Analysts use various techniques, such as cost accounting, sampling, and mathematical model building to analyze a problem and devise a new system. Once a system has been developed, they prepare charts and diagrams that describe its operation in terms that managers or customers can understand. They also may prepare a cost-benefit analysis to help the client decide whether the proposed system is satisfactory.

If the system is accepted, systems analysts translate the logical requirements of the system into the capabilities of the computer machinery or "hardware." They also prepare specifications for programmers to follow and work with them to "debug," or eliminate errors from the system. (The job of the computer programmer is described elsewhere in the *Handbook*.)

The problems systems analysts must solve range from monitoring nuclear fission in a powerplant to forecasting sales for an appliance manufacturing firm. Because the work is so varied and complex, analysts specialize in either business or scientific and engineering applications.

Some analysts improve systems already in use by developing better procedures or adapting the system to handle additional types of data. Others do research, called advanced systems design, to devise new methods of systems analysis.

Places of Employment

About 160,000 persons worked as systems analysts in 1976. Employment of these workers is concentrated in two geographic regions—more than one-third of the total are employed in the Midwest and about one-fourth work in the northeastern portion of the United States. Most systems analysts worked in urban areas for manufacturing firms, banks, insurance companies, and data processing service organizations. In addition, large numbers worked for wholesale and retail businesses and government agencies.

Training, Other Qualifications, and Advancement

There is no universally acceptable way of preparing for a job as a systems analyst because employers' preferences depend on the work being done. However, college graduates generally are sought for these jobs, and for some of the more complex jobs, persons with graduate degrees are preferred. Employers usually want analysts with a background in accounting, business management, or economics for work in a business environment while a background in the physical sciences, mathematics, or engineering is preferred for work in scientifically oriented organizations. A growing number of employers seek applicants with a degree in computer science, information science, or data processing. Regardless of college major, most employers look for people who are familiar with programming languages. Courses in computer concepts, systems analysis, and data retrieval techniques offer good preparation for a job in this field.

Prior work experience is important. Nearly half of all persons entering this occupation have transferred from other occupations, especially from computer programmer. In many industries, all systems analysts begin as programmers and are promoted to analyst positions after gaining experience.

Systems analysts must be able to think logically and should like working with ideas. The ability to concentrate and pay close attention to details also is important. Although most systems analysts work independently, they sometimes work in teams on large projects. They must be able to communicate effectively with technical personnel such as programmers as well as with clients who have no computer background.

In order to advance, systems analysts must continue their technical education. Technological advances come so rapidly in the computer field that continuous study is necessary to keep one's skills up to date. Training usually takes the form of 1-and 2-week courses offered by employers and software vendors.

An indication of experience and professional competence is the Certificate in Data Processing (CDP). This designation is conferred by the Institute for Certification of Computer Professionals upon candidates who have completed 5 years' experience and passed a five-part examination.

In large data processing departments, persons who begin as junior systems analysts may be promoted to senior or lead systems analysts after several years of experience. Systems analysts who show leadership ability also can advance to jobs as managers of systems analysis or data processing departments.

Employment Outlook

Employment of systems analysts is expected to grow faster than the average for all occupations through the mid-1980's as computer usage expands, particularly in accounting firms and organizations engaged in research and development. In addition to opportunities that will result from growth, some openings will occur as systems analysts advance to managerial positions or enter other occupations. Because many of these workers are relatively young, few positions will result from retirement or death.

The demand for systems analysts is expected to rise as computer capabilities are increased and computers are used to solve problems in a larger variety of areas. Sophisticated accounting systems, telecommunications networks, and complex mathematical systems used in scientific research are examples of new approaches in problem-solving. Over the next decade, we can expect systems analysts to be harnessing the computer's resources to solve problems we have not yet recognized. Advances in technology that have drastically reduced the size and cost of computer hardware will have differing effects on employment of systems analysts. Employment in data processing firms may not grow as rapidly as in recent years as more small businesses install their own computer rather than rely on a data processing service. This will be offset, however, by a rising demand for analysts to design systems especially for the small computer and geared specifically for the problems of small firms.

The outlook for graduates of computer-related curriculums should be excellent. College graduates who have had courses in computer programming, systems analysis, and other data processing areas should also find many opportunities. Persons without a college degree and college graduates unfamiliar with data processing may face competition from the large number of experienced workers seeking jobs as systems analysts.

Earnings and Working Conditions

Earnings for beginning systems analysts in private industry averaged $250 a week in 1976, according to surveys conducted in urban areas by the Bureau of Labor Statistics and private firms engaged in research on computer occupations. Experienced workers earned from $340 to $380, and lead systems analysts earned from $385 to $400 weekly. Overall, systems analysts earn well over twice as much as the average for all nonsupervisory workers in private industry, except farming.

In the Federal Government, the entrance salary for recent college graduates was about $180 a week in 1977. Salaries for systems analysts at all levels of responsibility generally are comparable to those in private industry.

Systems analysts working in the North and West earned somewhat more than those in the South and generally their earnings were greater in data processing service firms or in heavy manufacturing than in insurance companies or educational institutions.

Systems analysts usually work about 40 hours a week—the same as other professional and office workers. Unlike many computer operators, systems analysts are not assigned to evening or night shifts. Occasionally, however, evening or weekend work may be necessary to complete emergency projects.

Sources of Additional Information

Further information about the occupation of systems analyst is available from:

American Federation of Information Processing Societies, 210 Summit Ave., Montvale, N.J. 07645.

Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138.

Information about the Certificate in Data Processing is available from:

The Institute for Certification of Computer Professionals, 35 E. Wacker Dr., Suite 2828, Chicago, Ill. 60601.

BANKING OCCUPATIONS

Commercial banks constitute one of the fastest growing industries in our economy. To keep pace with requirements of the community, they offer a variety of services: Checking, savings, and credit card accounts, commerical and consumer loans, trust fund management, and financial counseling.

Banks employ highly specialized techniques and equipment in very detailed work. Consequently, most employees gain experience and skill through on-the-job training. Although banks usually seek college graduates for officer trainee jobs, many openings exist for high school graduates in other bank positions. Bank employees generally have good opportunities for advancement. They can qualify for better positions by enrolling in programs offered by the American Bankers Association, American Institute of Banking, or State banking associations, or by taking college courses in finance and business.

Bank employees should enjoy working with numbers and be able to perform detailed work. Personal qualifications such as honesty and the ability to communicate with customers are important.

This section discusses three categories of banking occupations: Clerks, officers and managers, and tellers.

BANK CLERKS

(D.O.T. 209.388, 210.388, 215.388 217.388, 219.388 and .488)

Nature of the Work

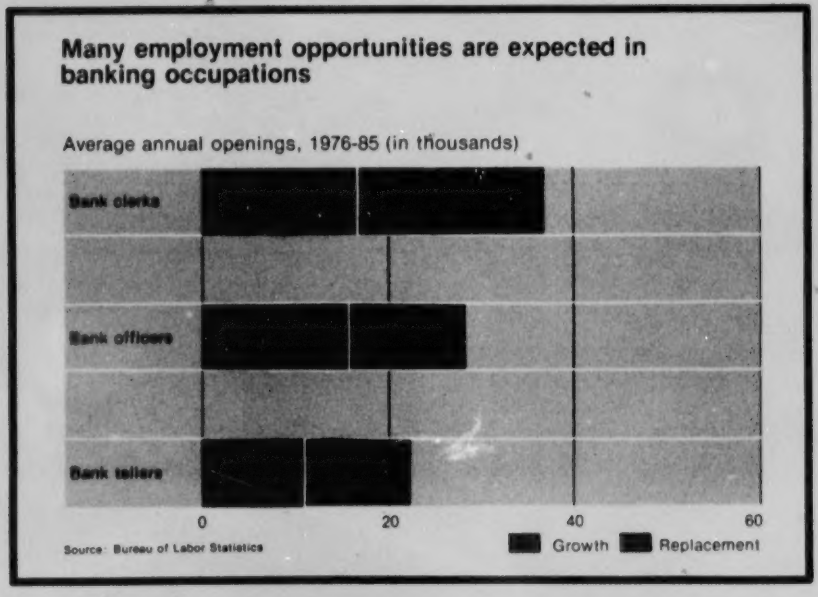
All organizations need clerks to handle paperwork. Because of the specialized nature of banking, some clerical duties in banks differ from those of other businesses. (Secretaries, typists, receptionists, file clerks, and other clerical workers whose jobs are much the same in banks as in other businesses are discussed in greater detail elsewhere in the *Handbook*.)

In a small bank, one clerk may do several jobs, such as sorting checks, totaling debit and credit slips, and preparing monthly statements for depositors. In a large bank, however, each clerk usually specializes and frequently has a special job title, as well.

Many bank clerks use office machines unique to banking. Clerks known as *sorters* (D.O.T. 219.388) separate documents—checks, deposit slips, and other items—into different groups and tabulate each "batch" so they may be charged to the proper accounts. Often clerks use canceling and adding machines in their work. *Proof machine operators* (D.O.T. 217.388) use equipment that sorts checks and deposit slips, adds their amounts, and records the tabulations.

Bookkeeping workers are the largest single group of bank clerks. *Bookkeeping machine operators* (D.O.T. 215.388) may use conventional bookkeeping machines or electronic posting machines to record financial transactions. In banks, these workers are sometimes known as account clerks, posting machine operators, or recording clerks. The job titles of *bookkeepers* (D.O.T. 210.388) sometimes relate to the kinds of records they keep—for example, Christmas club bookkeeper, discount bookkeeper, interest-accrual bookkeeper, trust bookkeeper, and commodity loan clerk. Thousands of *bookkeeping and accounting clerks* (D.O.T. 219.488) also do routine typing, calculating, and posting. Included in this group are reconcilement clerks, who process statements from other banks to aid the auditing of accounts, and trust investment clerks, who post the daily investment transactions of bank customers.

Other clerical employees whose duties and job titles are unique to banking include *country collection clerks* (D.O.T. 219.388), who sort thousands of pieces of mail daily and determine which items must be held at the main office and which should be routed to branch banks for collection. Also employed are *transit clerks* (D.O.T. 217.388), who sort checks



Clerks in large banks are usually assigned specialized duties.

and drafts on other banks, list and total the amounts involved, and prepare documents to be mailed for collection; *exchange clerks* (D.O.T. 219.388), who service foreign deposit accounts and determine charges for cashing or handling checks drawn against such accounts; *interest clerks* (D.O.T. 219.388), who keep records on interest-bearing items that are due to or from the bank; and *mortgage clerks* (D.O.T. 209.388), who type legal papers dealing with real estate upon which money has been loaned, and maintain records relating to taxes and insurance on these properties.

Electronic data-processing has created several new clerical occupations unique to banking. These include the electronic reader-sorter operator who runs electronic check sorting equipment; the check inscriber or encoder who operates machines that print information in magnetic ink on checks and other documents for machine reading; and the control clerk who keeps track of the large volume of documents flowing in and out of the computer division. Other occupations include card-tape converter operator, coding clerk, console operator, data typist, data converting machine operator, data examination clerk, high speed printer operator, tape librarian, teletype operator, and verifier operator.

Banks employed approximately 456,000 clerical workers in 1976; almost one-fifth were bookkeepers; one-fourth were stenographers, typists or secretaries; and almost one-fifth were office machine operators.

Training, Other Qualifications, and Advancement

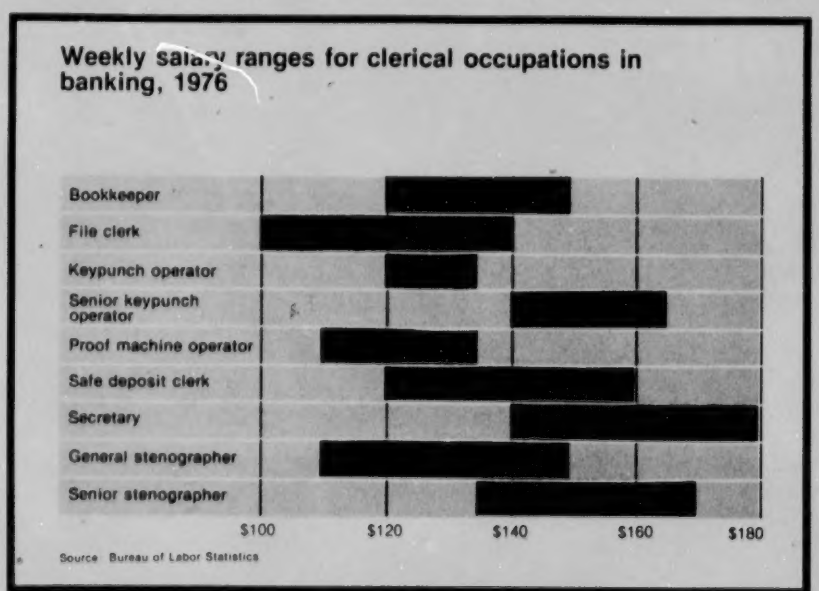
High school graduation is considered adequate preparation for most beginning clerical jobs in banks. Courses in bookkeeping, typing, business arithmetic, and office machine operation are desirable. Applicants may be given brief tests to determine their ability to work rapidly and accurately, and to communicate effectively with others. They should be able to work under close supervision as part of a team.

Beginners often are hired as file clerks, keypunch operators, transit clerks, or clerk-typists. Some are trained by the bank to operate various office machines. A few start as messengers.

A clerk in a routine job may be promoted to a clerical supervisory position, to teller or credit analyst, and eventually to senior supervisor. Advancement to a bank officer position is a possibility for outstanding clerks who have had college training or have taken specialized courses in banking. Additional education—particularly courses offered by the American Institute of Banking—may help workers advance. (See statement on the banking industry for information on the Institute's educational program.) In general, promotion depends upon the worker's performance, qualifications, and motivation as well as the available openings.

Employment Outlook

Employment of bank clerks is expected to grow faster than the aver-



age for other occupations through the mid-1980's. In addition to opportunities stemming from employment growth, many jobs will open up from the need to replace the large number of clerks who leave their jobs each year. As a result, banking should continue to be a good source of employment opportunities for clerical workers.

Jobs for clerks will arise as established banks expand their services and new banks and branches open. Future employment growth will differ markedly among individual clerical occupations. Nearly all banks use electronic equipment that lessens demand for workers such as check sorters and bookkeeping machine operators. Moreover, the need for keypunch operators is declining as banks shift from punched card- to magnetic tape-based computer systems.

No evidence suggests, however, that new technologies will displace large numbers of workers. Overall, the banking industry and employment of clerks in the banking industry are expected to grow. Workers whose duties are given to a machine most likely will be reassigned to new jobs created by the change or to duties related to new banking services.

Earnings

Beginning salaries for clerical workers depend upon the worker's actual position and length of experience, as well as the size and location of the bank. For reference, an inexperienced typist usually earned between $95 and $120 a week in 1976.

The accompanying chart indicates salary ranges for various clerical occupations in banking in 1976. In general, financial institutions have paid clerical workers lower salaries than have other industrial groups, such as wholesale trade or manufacturing. In 1973, clerical salaries in banking ran below the average for all industries; by 1976 this relative standing had not improved.

See the statement on the banking industry for additional information.

BANK OFFICERS AND MANAGERS

(D.O.T. 186.118, .138, .168, and .288; 161.118, 189.118 and .168)

Nature of the Work

Practically every bank has a president who directs operations; one or more vice presidents who act as general managers or who are in charge of bank departments such as trust or credit; and a comptroller or cashier who, unlike cashiers in stores and other businesses, is an executive officer generally responsible for all bank property. Large banks also may have treasurers and other senior officers, as well as junior officers, to supervise the various sections within different departments. Banks employed over 300,000 officers and managers in 1976.

Bank officers make decisions within a framework of policy set by the board of directors and existing laws and regulations. They must have a broad knowledge of business activities to relate to the operations of their department. For example, loan officers evaluate the credit and collateral of individuals and businesses applying for a loan. Similarly, trust officers must understand each account before they invest funds to support families, send young people to college, or pay retirement pensions. Besides supervising financial services, officers advise individuals and businesses and participate in community projects.

Because banks offer many services, a wide choice of careers is available to workers who specialize.

Loan officers may handle installment, commercial, real estate, or agricultural loans. To evaluate loan applications properly, officers need to be familiar with economics, production, distribution, merchandising, and commercial law. Also, they need to know business operations and should be able to analyze an industry's financial statements.

Bank officers in trust management require knowledge of financial planning and investment for investment research and for estate and trust administration.

Operations officers plan, coordinate, and control the work flow, update systems, and strive for administrative efficiency. Careers in bank operations include electronic data processing manager and other positions involving internal and customer services.

A loan officer evaluates an individual's credit rating before approving a loan.

A correspondent bank officer is responsible for relations with other banks; a branch manager, for all functions of a branch office; and an international officer, for advising customers with financial dealings abroad. A working knowledge of a foreign country's financial system, trade relations, and economic conditions is beneficial to those interested in international banking.

Other career fields for bank officers are auditing, economics, personnel administration, public relations, and operations research.

Training, Other Qualifications, and Advancement

Bank officer and management positions generally are filled by management trainees, and occasionally by promoting outstanding bank clerks or tellers. College graduation usually is required for management trainees. A business administration major in finance or a liberal arts curriculum including accounting, economics, commercial law, political science, and statistics serves as excellent preparation for officer trainee positions. In fact, a Master of Business Administration (MBA) in addition to a social science bachelor's degree comes closest to the "ideal" college education. However, banks do hire people with diverse backgounds such as chemical engineering, nuclear physics, and forestry to meet the needs of complex, high-technology industries with which they deal. Valuable experience may be gained through summer employment programs.

A management or officer trainee may spend a year or two learning the various banking areas before choosing a permanent position. This practice is common but not universal. A bank may hire an applicant with specific skills for a position that is clearly defined at the outset.

Persons interested in becoming bank officers should like to work independently and to analyze detailed information. They also need tact and good judgment to counsel customers and supervise employees.

Advancement to an officer or management position may come slowly in small banks where the number of positions is limited. In large banks that have special training programs, promotions may occur more quickly. For a senior officer position, however, an employee usually needs many years of experience.

Although experience, ability, and leadership are emphasized for promotion, advancement may be accelerated by special study. The American Bankers Association (ABA) offers courses, publications, and other training aids to officers on every phase of banking. The American Institute of Banking, an arm of the ABA, has long filled the same educational need among bank support personnel. (See the statement on the banking industry elsewhere in the *Handbook* for more information on these and other training programs sponsored by universities and local bankers' associations.)

Employment Outlook

Through the mid-1980's, employment of bank officers is expected to increase faster than the average for all occupations. Rising costs due to expanded banking services and the increasing dependence on computers will require more officers to provide sound management and effective quality control. Opportunities also will arise as experienced officers leave their jobs. College graduates who meet the standards for management trainees should find good opportunities for entry positions.

Earnings

Officer trainees at the bachelor's level generally earned between $800 and $900 a month in 1976. Those with an M.A. or M.S. started at between $1,000 and $1,200 a month. A Master of Business Administration, however, appears to be worth more in salary terms: graduates with an MBA were offered starting salaries of $1,300 to $1,400 a month in 1976.

Salaries of senior bank officers may be several times as much as starting salaries. The actual salary level depends upon the particular position and the size and location of the bank. For officers, as well as for other bank employees, earnings are likely to be lower in small towns than in big cities.

See the statement on the banking industry elsewhere in the *Handbook* for additional information on banking occupations.

BANK TELLERS

(D.O.T. 212.368)

Nature of the Work

Most bank customers have contact with the teller, the man or woman behind the window who cashes checks and processes deposits or withdrawals. Many banks employ one or two "all-purpose" tellers; larger banks employ tellers in more specialized functions. One teller, for example, sells saving bonds; another accepts payment for customers' utility bills. A third receives deposits for Christmas club accounts; and a fourth keeps records and performs the necessary paperwork for customer loans. Still other tellers handle foreign currencies, sell travelers' checks, or compute interest on savings accounts.

Commercial tellers, the most common, cash customers' checks and handle deposits and withdrawals from checking and savings accounts. Before cashing a check, the teller must see that the written and numerical amounts agree, verify the identity of the person to receive payment, and be certain that the payee's account has sufficient funds to cover the check. The teller must carefully count out the cash to avoid errors. Often a customer withdraws money in the form of a cashier's check, which the teller types up and verifies. When accepting a deposit, the teller checks the accuracy of the deposit slip and enters the total in a passbook or on a deposit receipt. Tellers may use machines to make change and total deposits. In some banks, tellers use computer terminals to record deposits and withdrawals In other banks, they write deposit receipts and passbook entries by hand.

Tellers' duties begin before and continue after banking hours. A teller begins the day by receiving and counting an amount of working cash

for his or her drawer; this amount is verified by a supervisor, usually the head teller. The tellers use this cash for payments during the day and are responsible for its safe and accurate handling. After banking hours, tellers count cash on hand, list the currency-received tickets on a settlement sheet, and balance the day's accounts. They also sort checks and deposit slips. Paying and receiving tellers may supervise one clerk or more. A teller generally works 37 to 40 hours per week.

For many young people just out of school, working as a teller is their first job. Because the job involves repetitive work with great attention to detail and long periods of time on one's feet, this occupation does not suit some people. The high rate of turnover suggests that, after a couple of years' work, many tellers seek other positions.

About 310,000 tellers were employed in 1976. A large number worked part time.

Training, Other Qualifications, and Advancement

In hiring tellers, banks seek people with basic qualities: clerical skills, friendliness, attentiveness. Although not required, a high school diploma is generally preferred. Maturity, neatness, tact, and courtesy are important because customers deal with tellers far more frequently than with other bank employees. Although tellers work independently, their record-keeping is closely supervised. They work with detail and are confined to a small work area.

New tellers usually observe experienced workers for a few days before doing the work themselves. Training may last from a few days to 3 weeks or longer. Beginners usually start as commercial tellers; in large banks which have a separate savings teller's "cage," they may start as savings tellers. Often banks simultaneously train tellers for other clerical duties.

The conditions governing advancement of tellers are much the same as those for clerks. The teller interested in promotion has access to courses and other sources of additional training. Such self-improvement efforts, coupled with satisfactory performance on the job, would make a teller an attractive candidate for promotion. After gaining experience, a teller in a large bank may advance to head teller; those who have had some college or specialized training offered by the banking industry may be promoted to an officer's or managerial position. (See the statement on the banking industry for information about the educational programs of the American Institute of Banking.)

Employment Outlook

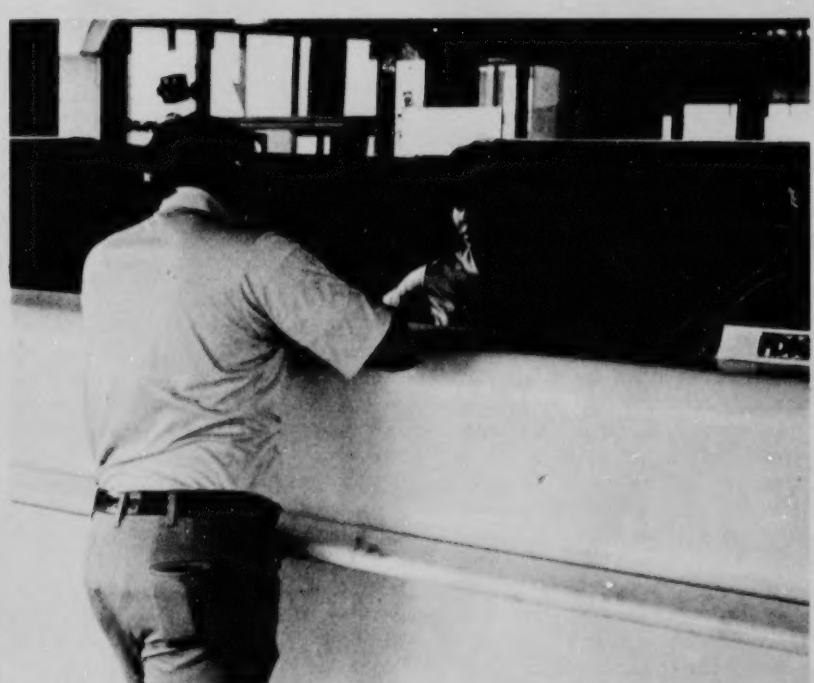
The number of bank tellers is expected to increase faster than the average for all occupations through the mid-1980's as banks expand services. Thousands of openings will occur each year as a result of employment growth and the need to replace tellers who retire, die, or stop working for other reasons. The relatively high replacement needs in this occupation are expected to be an important source of job opportunities. Qualified applicants should find good employment prospects.

Although increased use of mechanical and electronic equipment may eliminate some routine duties and speed other work, total employment is not likely to be adversely affected.

Earnings

Most beginning tellers earned between $95 and $120 a week in 1976. Experienced tellers generally earned between $125 and $175 a week. The actual salary depends upon the length of service, the location and size of the bank, and the worker's specific duties. Most savings tellers, for example, earned between $125 and $145 a week in 1976, while note tellers usually earned between $150 and $170 a week. In general, the greater the range of responsibilities the teller performs, the higher his or her salary.

See the statement on the banking industry elsewhere in the *Handbook* for additional information on this and other banking occupations.



132 An increasing number of tellers will be needed to work part time.

INSURANCE OCCUPATIONS

Insurance protection is an integral part of our lives. It frees policyholders and their beneficiaries from worry about the enormous financial burdens that sometimes result from death, illness, or other losses. Businesses could not operate, nor could most people buy homes or other major items, without the assurance of protection from sudden disaster. Insurance workers adapt policies to meet changing needs, decide which applications can be accepted and establish premium rates on the policies, and investigate and settle claims.

A college degree is increasingly important for managerial, professional, and sales jobs in insurance, although some positions are open to high school graduates who have appropriate experience. Insurance workers in clerical positions need a high school diploma. Regardless of their previous training, insurance workers must continually learn while on the job. Many professional associations sponsor courses in all phases of insurance work; employees are encouraged to participate to prepare themselves for more responsible jobs.

This section describes three insurance occupations: actuaries, claim representatives, and underwriters. (Statements on the insurance industry and insurance agents and brokers are included elsewhere in the *Handbook*.)

ACTUARIES

(D.O.T. 020.188)

Nature of the Work

Why do young persons pay more for automobile insurance than older persons? How much should an insurance policy cost? Answers to these and similar questions are provided by actuaries who design insurance and pension plans that can be maintained on a sound financial basis. They assemble and analyze statistics to calculate probabilities of death, sickness, injury, disability, unemployment, retirement, and property loss from accident, theft, fire, and other potential hazards. Actuaries use this information to determine the expected insured loss. For example, they may calculate how many persons who are 21 years old today can be expected to live to age 65—the probability that an insured person might die during this period is a risk to the company. They then calculate a price for assuming this risk that will be profitable to the company yet be competitive with other insurance companies. Finally, they must make sure that the price charged for the insurance will enable the company to pay all claims and expenses as they occur. In the same manner, the actuary calculates premium rates and determines policy contract provisions for each type of insurance offered. Most actuaries specialize in either life and health insurance or property and liability (casualty) insurance; a growing number specialize in pension plans.

To perform their duties effectively, actuaries must keep informed about general economic and social trends, and legislative, health, and other developments that may affect insurance practices. Because of their broad knowledge of insurance, company actuaries may work on problems arising in their company's investment, group underwriting, or pension planning departments. Actuaries in executive positions help determine general company policy. In that role, they may be called upon to explain complex technical matters to company executives, government officials, policyholders, and the public. They may testify before public agencies on proposed legislation affecting the insurance business, for example, or explain intended changes in premium rates or contract provisions.

Actuaries who work for the Federal Government usually deal with a particular insurance or pension program, such as social security or life insurance for veterans and members of the Armed Forces. Actuaries in State government positions regulate insurance companies, supervise the operations of State retirement or pension systems, and work on problems connected with unemployment insurance or workers' compensation. Consulting actuaries set up pension and welfare plans for private compa-

Employment of actuaries is influenced by the volume of insurance sales.

nies, unions, and government agencies. They calculate future benefits and determine the amount of the annual employer contribution. Actuaries who are enrolled under the provisions of the Employee Retirement Income Security Act of 1974 (ERISA) evaluate these pension plans and submit reports certifying their financial soundness.

Places of Employment

Approximately 9,000 persons worked as actuaries in 1976. Four of every 10 actuaries worked in five major cities—New York, Hartford, Chicago, Philadelphia, and Boston.

About two-thirds of all actuaries worked for private insurance companies. Almost 90 percent of these worked for life insurance companies; the rest worked for property and liability (casualty) companies. The number of actuaries employed by an insurance company depends on the volume of its business and the number and types of insurance policies it offers. Large companies may employ over 100 actuaries on their staffs; others, generally smaller companies, may rely instead on consulting firms or rating bureaus (associations that supply actuarial data to member companies).

Consulting firms and rating bureaus employ about one-fifth of all actuaries. Other actuaries work for private organizations administering independent pension and welfare plans or for Federal and State government agencies. A few teach in colleges and universities.

Training, Other Qualifications, and Advancement

A good educational background for a beginning job in a large life or casualty company is a bachelor's degree with a major in mathematics or statistics; a degree in actuarial science is even better. Some companies hire applicants with a major in engineering, economics, or business administration, provided they demonstrate a thorough foundation in calculus, probability, and statistics (20-25 hours). Other desirable courses are insurance law, economics, and accounting. Although only 25 colleges and universities offer a degree in actuarial science, several hundred schools offer a degree in mathematics or statistics.

A strong background in mathematics is essential for persons interested in a career as an actuary. Of equal importance, however, is the need to pass while in school one or more of the examinations offered by professional societies. Three societies sponsor programs leading to full professional status in their speciality. The Society of Actuaries gives 9 actuarial examinations for the life and health insurance and pension field, the Casualty Actuarial Society gives 10 examinations for the property and liability field, and the American Society of Pension Actuaries gives nine examinations covering the pension field. Because the first parts of the examination series of each society cover similar materials, students need not commit themselves to a career specialty until they have taken about four examinations. Success in passing the first few examinations helps students evaluate their potential as actuaries. Those who pass these examinations usually have better opportunities for employment and receive a higher starting salary.

Actuaries are encouraged to complete an entire series of examinations as soon as possible. It generally takes from 5 to 10 years to complete the series required for full professional status. Examinations are given twice each year. Extensive home study is required in order to pass the advanced examinations; many actuaries spend as much as 20-25 hours a week studying. Actuaries who complete five examinations in either the life insurance series or the pension series or seven examinations in the casualty series are awarded "associate" membership in their respective society. Those who have passed an entire series receive full membership and the title "fellow."

Consulting pension actuaries who service private pension plans and certify their solvency must be enrolled by the Joint Board for the Enrollment of Actuaries. Applicants for enrollment must meet certain experience and education requirements as stipulated by the Joint Board.

Beginning actuaries often rotate among different jobs to learn various actuarial operations and to become familiar with different phases of insurance work. At first, their work may be rather routine, such as preparing calculations or tabulations for actuarial tables or reports. As they gain experience, they may supervise actuarial clerks, prepare correspondence and reports, and do research.

Advancement to more responsible work as assistant, associate, and chief actuary depends largely on job performance and the number of actuarial examinations passed. Many actuaries, because of their broad knowledge of insurance and related fields, are selected for administrative positions in other company activities, particularly in underwriting, accounting, or data processing departments. Many actuaries advance to top executive positions.

Employment Outlook

Employment of actuaries is expected to rise faster than the average for all occupations through the mid-1980's. In addition to job openings resulting from this growth, several hundred actuaries will be needed each year to replace those who retire; die, or transfer to other occupations. Job opportunities will be best for new college graduates who have passed at least two actuarial examinations while still in school and have a strong mathematical and statistical background. However, because of the large number of persons expected to receive degrees in actuarial science, mathematics, and statistics, and the large number of students taking actuarial examinations, competition for beginning jobs should remain keen.

Employment in this occupation is influenced to a great extent by the volume of insurance sales, which will continue to grow over the next decade. Shifts in the age distribution of the population through the mid-1980's will result in many more people with established careers and family responsibilities. This is the group that traditionally has accounted for the bulk of private insurance sales.

Increased sales, however, are only one determinant of the demand for actuaries. In addition, changes in existing insurance practices are creating a need for more actuarial services. As more and more insurance

companies branch out into more than one kind of insurance coverage, a greater number of actuaries will be needed to establish the rates for the variety of insurance offered. Growth in sales of relatively new forms of protection, such as dental, prepaid legal, and kidnap insurance will create additional demand for actuaries. As more States pass competitive rating laws, many companies that previously relied on rating bureaus for actuarial data can be expected to expand existing actuarial departments or create new ones.

Recent court decisions concerning product liability have focused much attention on this complex area. In the years ahead, actuaries will be spending a lot of time developing better ways to provide product liability, medical malpractice, and workers' compensation insurance protection.

Adoption of a "no-fault" automobile insurance plan requires companies writing automobile insurance to reevaluate their pricing structures in light of no-fault requirements. It is uncertain whether Federal no-fault legislation will be enacted soon; however, the growing number of States enacting no-fault plans or revising existing ones indicates continued strong demand for actuaries to make the required analyses.

ERISA has imposed strict responsibilities on actuaries for the operation and funding of pension plans. As the number of pension plans continues to grow, there will be an increasing need for pension specialists to develop adequately financed plans and to prepare the reports that certify their solvency.

Earnings and Working Conditions

In 1976, actuaries had average salaries more than twice as high as the average for all nonsupervisory workers in private industry, except farming. New college graduates entering the life insurance field without having passed any actuarial exams averaged $10,600 in 1976, according to a survey of U.S. companies by the Life Office Management Association (LOMA). Applicants who had successfully completed the first exam received $11,200 and those who had passed two exams averaged $11,800.

In the Federal Government, new graduates with the bachelor's degree could start at $9,300 a year in 1977. Applicants with either 1 year of graduate study or relevant work experience were hired at $11,500, and those with the master's degree or 2 years' experience started at $14,100 a year. Actuaries in the Federal Government averaged $25,100 a year in 1977.

Beginning actuaries can look forward to a marked increase in earnings as they gain professional experience and advance in an actuarial society's examination program. Life insurance companies usually give merit increases averaging from $500 to $850 to their actuaries as they pass each successive examination leading to membership in the Society of Actuaries. Associates who received that designation in 1976 averaged $16,500 a year; salaries for actuaries who were awarded a full fellowship during that year averaged $24,800. Fellows with additional years of experience earned substantially more—top actuarial executives averaged about $43,000 in 1976.

Although data are not available for salaries paid actuaries in casualty companies or consulting firms, it is believed that salaries for these specialists generally are comparable to those paid by life insurance companies.

Sources of Additional Information

For facts about actuarial opportunities and qualifications, contact:

American Society of Pension Actuaries, 1700 K St., NW., Washington, D.C. 20006.

Casualty Actuarial Society, 200 East 42nd St., New York, N.Y. 10017.

Society of Actuaries, 208 South LaSalle St., Chicago, Ill. 60604.

CLAIM REPRESENTATIVES

(D.O.T. 168.288, 241.168, and 249.268)

Nature of the Work

Fast and fair settlement of all claims is essential to any insurance company if it is to meet its commitments to policyholders and also protect its own financial well-being. The people who investigate claims, negotiate settlement with policyholders, and authorize payment are known as claim representatives—a group that includes claim adjusters and claim examiners.

When a property-liability (casualty) insurance company receives a claim, the *claim adjuster* determines whether the policy covers it and the amount of the loss. Adjusters use reports, physical evidence, and testimony of witnesses in investigating a claim. When their company is liable, they negotiate with the claimant and settle the case.

Adjusters must make sure that settlements are in line with the real extent of the loss. They must protect their company from false or inflated claims but, at the same time, settle valid claims fairly and promptly. Some adjusters are allowed to issue checks on company funds; most, however, submit their findings to claim examiners who review them to insure that proper procedures have been followed and then authorize payment.

Some adjusters work with all lines of insurance. Others specialize in claims from property damage by fire, marine loss, automobile damage, workers' compensation loss, or product liability. Several States have "no-fault" automobile insurance plans that relieve the adjuster from determining responsibility for a loss. Adjusters in these States still must decide the amount of loss, however. A growing number of casualty companies employ special claims people to settle small claims, usually minor automobile or homeowner damage claims. These claim workers, generally called "inside adjusters" or "telephone adjusters," contact claimants by telephone or mail and have the policyholder send repair costs, medical bills, and other statements to the company. Many companies centralize this operation in a drive-in claims center where the cost of repair is determined and a check is issued on the spot.

Claims adjuster gathering evidence in investigating a claim.

Adjusters work away from the office most of the time. They may be called to the site of an accident or to the location of a fire or burglary. Adjusters make their own schedules of the activities needed to dispose of a claim properly. They also keep written or taped records of information obtained from witnesses and other sources and prepare reports of their findings.

In life insurance companies, the counterpart of the claim adjuster is the *claim examiner*, who investigates the details surrounding questionable claims or those exceeding a specified amount. They may check claim applications for completeness and accuracy, interview medical specialists, consult policy files to verify information on a claim, or calculate benefit payments. Generally, examiners are authorized to investigate and approve payment on all claims up to a certain limit; larger claims are referred to a senior examiner.

Examiners checking incorrect or questionable claims may correspond with investigating companies, field managers, agents, or the family of the insured. Claim examiners occasionally travel to obtain information by personal interview, or contact State insurance departments and other insurance companies. In addition to verifying claims and approving payment, examiners also maintain records of settled claims and prepare reports to be submitted to their company's data processing department. Some experienced examiners serve on committees, conduct surveys of claim practices within their company, and help devise more efficient ways to process claims. They, like claim adjusters, sometimes testify in court on contested claims.

Places of Employment

About 155,000 persons worked as claim representatives in 1976.

The majority of claim adjusters worked for insurance companies that sell property and liability coverage. Some were employed by independent adjusting firms that contract their services for a fee. These independent firms range from national companies employing hundreds of adjusting specialists to small 3- or 4-person local operations. A relatively small number of adjusters represent the insured rather than the insurance company. These "public adjusters" usually are retained by banks, financial organizations, and other business firms to handle fire and other losses to property. They negotiate claims against insurance companies and deal with adjusters for such companies.

Most claim examiners worked for life insurance companies in large cities such as New York, San Francisco, Chicago, Dallas, and Philadelphia, where most home offices are located.

Adjusters may travel to almost any area of the United States, since claims must be settled locally. Occasionally, an experienced adjuster may travel to the scene of a disaster, such as a hurricane or a riot, to work with local personnel. Some cases result in travel outside the United States.

Training, Other Qualifications, and Advancement

Although a growing number of insurance companies prefer claim representatives to have a college degree, many hire those without college training, particularly if they have specialized experience. For example, persons experienced in automobile repair work may qualify as auto adjusters, and those with clerical work experience might be hired as inside adjusters.

No specific field of college study is recommended. Although courses in insurance, economics, or other business subjects are helpful, a major in almost any college field is adequate preparation. An adjuster who has a business or accounting background might specialize in loss from business interruption or damage to merchandise. Those with college training in engineering will find their education helpful in adjusting industrial claims. A legal background is most helpful to those handling workers' compensation and product liability cases.

Most large insurance companies provide beginning claim adjusters and examiners on-the-job training and home study courses. Claim representatives are encouraged to take courses designed to enhance their professional skills. For example, the Insurance Institute of America offers a six-semester study program leading to an associate degree in claims adjusting upon successful completion of six examinations. Adjusters can prepare for these examinations by independent home study or through company or public classes. A professional Certificate in Insurance Adjusting also is available from the College of Insurance in New York City.

The Life Office Management Association (LOMA) in cooperation with the International Claim Associ-

ation offers a claims education program for life and health examiners. The program is part of the LOMA Institute Insurance Education Program leading to the professional designation, FLMI (Fellow, Life Management Institute) upon successful completion of eight written examinations.

About three-fourths of the States require adjusters to be licensed. Despite wide variation in State licensing requirements, applicants usually must comply with one or more of the following: Pass a written examination covering the fundamentals of adjusting; furnish character references; be 20 or 21 years of age and a resident of the State; offer proof that they have completed an approved course in insurance or loss adjusting; and file a surety bond.

Because they often work closely with claimants, witnesses, and other insurance professionals, representatives must be able to adapt to many different persons and situations. They should be able to communicate effectively and gain the respect and cooperation of people from different backgrounds. For example, when adjusters' evaluations of claims differ from those of the persons who have suffered the loss, they should be able to explain their conclusions tactfully. Examiners need to be familiar with medical and legal terms and practices and Federal and State insurance laws and regulations. Because they may have to check premium payments, policy values, and other numerical items in processing a claim, examiners should be adept at making mathematical calculations. Both adjusters and examiners should have a good memory and enjoy working with details.

Beginning adjusters and examiners work on small claims under the supervision of an experienced worker. As they learn more about claim investigation and settlement, they are assigned claims that are higher in loss value and more difficult. Trainees are promoted as they demonstrate competence in handling assignments and progress in the courses they take. Because of the complexity of insurance regulations and claims procedures, workers who lack formal academic training may advance more slowly than those with 2 years or more of college. Employees who show unusual competence in claims work or outstanding administrative skills may be promoted to department supervisor in a field office or to a managerial position in the home office. Qualified adjusters and examiners sometimes transfer to other departments, such as underwriting or sales.

Employment Outlook

Employment of claim representatives is expected to grow about as fast as the average for all occupations through the mid-1980's as the number of insurance claims continues to increase. In addition to jobs created by growth of the occupation, many others will result from the need to replace workers who die, retire, or transfer to other jobs.

Several factors point to a growing volume of insurance and a resulting need for claim adjusters. Over the next decade a steadily rising number of workers will be entering their most productive years. These workers and their families are likely to seek insurance protection as they purchase homes, automobiles, and other consumer durables. New or expanding businesses will need protection for new plants and equipment and for insurance covering their employees' health and safety. As more people live and work in densely populated areas, the increased risk of automobile accident, fire, or theft should result in a greater number of claims.

As ways of doing business continue to change, the demand for certain kinds of claim adjusters will be stronger than for others. For example, the growing trend toward drive-in claim centers and claim handling by telephone should reduce the demand for automobile adjusters while it stimulates demand for inside adjusters. Independent adjusters who specialize in automobile damage claims should continue to suffer some loss of business. Prospects should be very good, however, for adjusters who specialize in highly complex types of business insurance such as marine cargo, workers' compensation, and product liability.

A similar situation exists for claim examiners. Employment of examiners in casualty companies should rise about as fast as for adjusters; however, much slower growth is expected for life insurance examiners as increased use of computers enables them to process more claims, especially routine ones and those that arise under group policies.

Earnings and Working Conditions

According to a recent survey of property and liability companies, claim adjusters averaged about $13,000 a year in 1976; inside adjusters earned average salaries of about $9,900. Most public adjusters are paid a percentage of the amount of the settlement—generally 10 percent. Adjusters are furnished a company car or are reimbursed for use of their own vehicles for business purposes. Salaries of claim adjusters are about one and one-half times the average earnings for all nonsupervisory workers in private industry, except farming; salaries of inside adjusters are slightly above the average for all nonsupervisory work

A survey of life insurance companies by the Life Office Management Association revealed that claim examiners earned average salaries of $13,300 a year in 1976. According to the survey of property and liability companies, casualty claim examiners averaged $15,280. Claim supervisors in casualty companies and life companies averaged $17,300 a year. Claim examiners earn more than 1 1/2 times the average for all nonsupervisory workers in private industry, except farming.

Claim adjusting is not a desk job. It requires that a person be physically fit because much of the day may be spent in traveling from one place to another, walking about outdoors, and climbing stairs. Adjusters may have to work evenings or weekends in order to interview witnesses and claimants when they are available. Since most companies provide 24-hour claim service to their policyholders, some adjusters always must be on call. (See the statement on the Insurance Industry for additional information on working conditions and employee benefits.)

Claim examiners have desk jobs that require no unusual physical ac-

tivity. Although the average workweek for examiners is 35 to 40 hours, they may work longer at times of peak claim loads or when quarterly and annual statements are prepared. They also may need to travel occasionally.

Sources of Additional Information

General information about a career as a claim examiner or adjuster is available from the home offices of many life and property and liability insurance companies.

Information about licensing requirements for claim adjusters may be obtained from the department of insurance in each State.

Information about career opportunities in these occupations also may be obtained from:

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 N. Wacker Dr., Chicago, Ill. 60606.

The National Association of Independent Insurers, Public Relations Department, 2600 River Rd., Des Plaines, Ill. 60018.

For information about public insurance adjusting, contact:

National Association of Public Adjusters, 1613 Munsey Building, Baltimore, Md. 21202.

Career information on life insurance claim examining is available from:

American Council of Life Insurance, 1850 K St., NW., Washington, D.C. 20006.

UNDERWRITERS

(D.O.T. 169.188)

Nature of the Work

Insurance companies assume millions of dollars in risks each year by transferring chance of loss from their policyholders to themselves. Underwriters appraise and select the risks their company will insure. (The term underwriter sometimes is used in referring to insurance agents; see the statement on insurance agents and brokers elsewhere in the *Handbook* for a discussion of that occupation.)

Underwriters analyze information presented on policy applications.

Underwriters decide whether their companies will accept risks after analyzing information in insurance applications, reports from loss control consultants, medical reports, and actuarial studies (reports that describe the probability of insured loss). Some routine applications that require very little independent judgment are handled by computers. Generally, however, underwriters use considerable personal judgment in making decisions. Because these decisions are seldom reviewed at a higher level, underwriters have great responsibility. Their companies may lose business to competitors if they appraise risks too conservatively or may have to pay many future claims if their underwriting actions are too liberal.

When deciding that a policy is an acceptable risk, an underwriter may outline the terms of the contract, including the amount of the premium. Underwriters frequently correspond with policyholders, agents, and managers about policy cancellations or requests for information. In addition, they sometimes accompany salespeople on appointments with prospective customers.

Most underwriters specialize in one of three major categories of insurance: life, property and liability, or health. They further specialize in group or individual policies. The property and liability underwriter specializes by type of risk insured, such as fire, automobile, marine, or workers' compensation. Some underwriters, called commercial account underwriters, handle business insurance exclusively. They often must evaluate a firm's entire operation in appraising its insurance application. There is a growing trend in casualty companies toward "package" underwriting, where various types of risks are insured under a single policy. In such a situation, the underwriter would have to be familiar with several different lines of insurance rather than specializing in a single line.

An increasing proportion of total insurance sales is being made through group contracts. A standard group insurance policy insures all persons in a specified group through a single contract at uniform premium rates, this type of group policy generally provides life or health insurance protection. The group underwriter analyzes the overall composition of the group to be sure that total risk is not excessive. A different type of group policy finding increasing acceptance is the policy that provides the members of a group—a labor union, for example—with individual policies geared to their own circumstances. These policies generally are in the casualty field, covering automobiles, pleasure boats, and homes. The casualty underwriter analyzes the application of each group member and makes individual appraisals. Some group underwriters attend meetings with union or employer representatives to discuss the types of policies available to their groups.

Places of Employment

An estimated 25,000 persons worked as insurance underwriters in 1976. Over three-fourths were property and liability underwriters working in regional or home offices throughout the United States; most life insurance underwriters are in home offices in a few large cities, such as New York, San Francisco, Chicago, Dallas, and Philadelphia.

Training, Other Qualifications, and Advancement

For beginning underwriting jobs, most large insurance companies seek college graduates who have a degree in liberal arts or business administration, but a major in almost any field provides a good general background. Some small companies hire persons with less than a college degree for underwriter trainee positions. In addition, some high school graduates who begin as underwriting clerks may be trained as underwriters after they demonstrate an aptitude for the work.

Underwriter trainees begin by evaluating routine applicants under the close supervision of an experienced risk appraiser. They study claim files to become familiar with factors associated with certain types of losses. As they develop the sound judgment that is required, they are assigned policy applications that are more complex and have a greater face value.

Continuing education is a necessity if the underwriter expects to advance to senior level positions. Insurance companies generally place great emphasis on completion of one or more of the recognized independent study programs. Many companies pay tuition and the cost of books for those who satisfactorily complete underwriting courses; some offer salary increases as an additional incentive. Independent study programs are available through the American Institute of Property and Liability Underwriters, the American College of Life Underwriters, the Academy of Life Underwriters, the Health Insurance Association of America, and the Life Office Management Association.

Underwriting can be a satisfying career for persons who like working with details and enjoy relating and evaluating information. In addition to analyzing problems, underwriters must make prompt decisions and be able to communicate their ideas to others. They must also be imaginative and aggressive, especially when they have to get additional information from outside sources.

Experienced underwriters who complete study courses may advance to chief underwriter or underwriting manager. Some underwriting managers are promoted to senior managerial jobs after several years.

Employment Outlook

Employment of underwriters is expected to rise about as fast as the average for all occupations through the mid-1980's as insurance sales continue to expand. Each year many jobs will become available as the occupation grows and as those who die, retire, or transfer to other work are replaced.

Several factors underlie the expected growth in the volume of insurance and the resulting need for underwriters. Over the next decade, a much larger portion of our population will enter their most productive years. As this traditional market for life insurance expands, the volume of insurance sales also should rise. This will occur as more individuals purchase life insurance to protect their families' standard of living, finance their children's education, or provide retirement income. Property and liability insurance sales also should expand as purchases of automobiles, pleasure boats, and other consumer durables increase. Both spending for new home construction and the American public's growing security consciousness should contribute to demand for more extensive insurance protection. New or expanding businesses will need protection for new plants and equipment and insurance for workers' compensation and product liability. Heightened competition among insurance companies and changes in regulations affecting investment profits also are expected to increase the insurance industry's need for competent underwriters.

Earnings and Working Conditions

Underwriters in life insurance who had 2 to 4 years' experience averaged $12,600 a year in 1976, according to a Life Office Management Association (LOMA) survey. Senior life underwriters (those with 5 to 8 years' experience) averaged $16,600, while senior group underwriters earned average salaries of $17,400. Supervisors of underwriting in life insurance companies averaged $17,500 to $23,000. In most cases, underwriters in larger companies earned higher salaries.

A recent survey of companies that sell property and liability insurance showed that underwriters with 2 to 4 years' experience averaged $12,300 a year in 1976. Earnings varied substantially by underwriting specialty, however: personal lines underwriters earned average salaries of $11,700, while those specializing in surety bonds averaged $14,300. Senior underwriters earned substantially higher incomes—personal lines underwriters averaged $15,200 while those specializing in commercial lines received an average of $15,000 a year. Experienced underwriters earn about 1 1/2 times the average earnings of nonsupervisory workers in private industry, except farming. Underwriting supervisors in property and liability companies averaged $17,500 a year in 1976.

Most underwriters have desk jobs that require no unusual physical activity. Although the average week is 37 hours, underwriters sometimes work overtime. Most insurance companies have liberal vacation policies and other employee benefits. (See the statement on the Insurance Industry for additional information on working conditions and employee benefits.)

Sources of Additional Information

General information about a career as an insurance underwriter is available from the home offices of many life insurance and property and liability insurance companies. Information about career opportunities as an underwriter also may be obtained from:

American Council of Life Insurance, 1850 K St., NW., Washington, D.C. 20006

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 N. Wacker Dr., Chicago, Ill. 60606.

The National Association of Independent Insurers, Public Relations Department, 2600 River Rd., Des Plaines, Ill. 60018.

ADMINISTRATIVE AND RELATED OCCUPATIONS

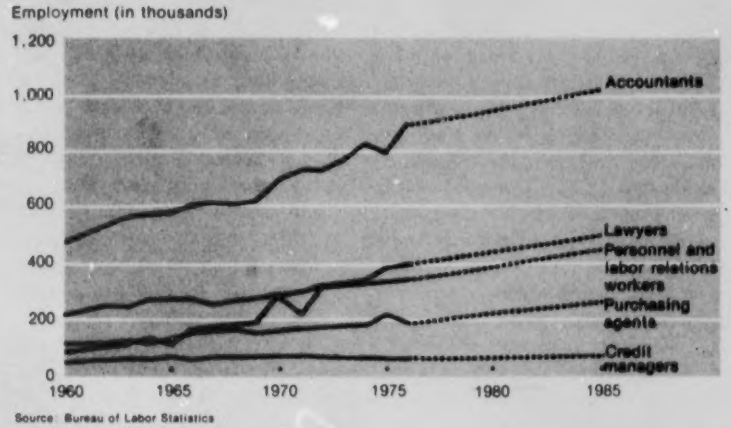
Most administrative workers are professional office employees who run, or help run, business and other organizations. Some are managers, who supervise, plan operations, and make company policy. Others provide assistance to managers, such as personnel workers who recruit and hire staff members or accountants, whose information helps managers make difficult decisions. The success or failure of an organization depends heavily on the way administrative workers do their jobs.

Nearly all administrative jobs require a college degree, although employers vary in the specific area of study they prefer. Some seek business administration or liberal arts graduates; others want a background in a technical area such as engineering or science.

Many administrative workers solve problems and make decisions using numbers and technical data. In addition, these workers must be tactful and able to get along with others. They also must be able to handle the uneven flow of work in offices.

This section describes several administrative occupations including city managers, accountants, credit officials, and personnel and labor relations workers.

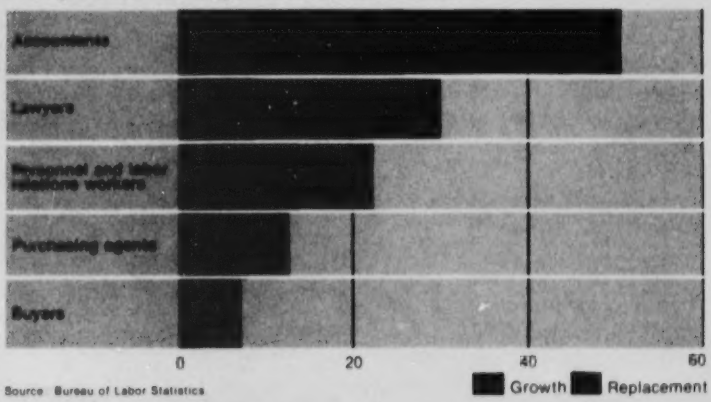
The number of employees in administrative occupations varies widely by occupation



Source: Bureau of Labor Statistics

Openings vary greatly among administrative and related occupations

Selected administrative and related occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

ACCOUNTANTS

(D.O.T. 160.188)

Nature of the Work

Managers must have up-to-date financial information to make important decisions. Accountants prepare and analyze financial reports that furnish this kind of information.

Three major accounting fields are public, management, and government accounting. Public accountants have their own businesses or work for accounting firms. Management accountants, also called industrial or private accountants, handle the financial records of the company they work for. Government accountants examine the records of government agencies and audit private businesses and individuals whose dealings are subject to government regulations.

Accountants often concentrate on one particular phase of accounting. For example, many public accountants specialize in auditing (reviewing a client's financial records and reports to judge their reliability). Others specialize in tax matters, such as preparing income tax forms and advising their clients of the advantages and disadvantages of certain business

Traveling auditor reviewing financial records at a company plant.

decisions. Still others become specialists in management consulting and give advice on a variety of matters. They might develop or revise an accounting system to serve the needs of clients more effectively or give advice about different types of accounting equipment.

Management accountants provide the financial information executives need to make sound business decisions. They may choose to work in areas such as taxation, budgeting, or investments. Internal auditing is an area of specialization within management accounting that is rapidly growing in importance. Accountants who work as internal auditors examine and evaluate their firm's financial systems and management control procedures to ensure efficient and economical operation.

Many accountants in the Federal Government work as Internal Revenue agents, investigators, and bank examiners; other government accountants have regular accounting positions.

Places of Employment

About 865,000 people worked as accountants in 1976. Almost 20 percent were Certified Public Accountants (CPA's) and nearly 12 percent were Certified Internal Auditors (CIA's).

About 60 percent of all accountants do management accounting work; one-fifth of these work as internal auditors. An additional 25 percent are engaged in public accounting as proprietors, partners, or employees of independent accounting firms. Other accountants work for Federal, State, and local government agencies, and a small number teach in colleges and universities. Opportunities are plentiful for part-time work in accounting, particularly in smaller firms.

Accountants are found in all business, industrial, and government organizations. Most, however, work in large urban areas where many public accounting firms and central offices of large businesses are concentrated. For example, over 20 percent of all accountants are employed in just four major cities: Chicago; Los Angeles; New York; and Washington, D.C.

Training, Other Qualifications, and Advancement

Training in accounting is available at colleges and universities, accounting and business schools, and correspondence schools. Although many graduates of business and correspondence schools are successful in small firms, most large public accounting and business firms require applicants for accountant and internal auditor positions to have at least a bachelor's degree in accounting or a closely related field. Many employers prefer those with the master's degree in accounting. A growing number of large employers prefer applicants who are familiar with computer technology for both accounting and internal auditor positions. For beginning accounting positions, the Federal Gov-

ernment requires 4 years of college training (including 24 semester hours in accounting) or an equivalent combination of education and experience. For teaching positions, most colleges and universities require at least the master's degree or the Certified Public Accountancy Certificate.

Previous work experience in accounting can help an applicant get a job. Many colleges offer students an opportunity to gain experience through internship programs conducted by public accounting or business firms.

Anyone working as a "certified public accountant" must hold a certificate issued by the State board of accountancy. All states use the CPA examination, prepared by the American Institute of Certified Public Accountants, to establish certification. Most successful candidates have college degrees, and three-fourths of the States require CPA candidates to be college graduates. Nearly all States require applicants to have at least 2 years of public accounting experience for a CPA certificate.

Requirements vary, but more than half the States restrict the title "public accountant" to those who are licensed or registered. Some States require only a high school diploma while others require 2 years of college or more. Information on requirements may be obtained directly from individual State boards of accountancy or from the National Society of Public Accountants.

The recognized mark of competence and experience in the field of internal auditing is the designation, Certified Internal Auditor (CIA). The Institute of Internal Auditors, Inc., confers this designation upon candidates who have completed 3 years' experience in internal auditing and who have passed a four-part examination. Beginning in 1978, a bachelor's degree from an accredited college or university also will be required.

Persons planning a career in accounting should have an aptitude for mathematics. Neatness and accuracy also are necessary. Employers seek applicants who can handle responsibility and work with little supervision.

To get to the top in the profession, accountants usually must continue their study of accounting even though they already have a college degree or professional certificates. They may participate in seminars sponsored by various professional associations or take courses offered by their employers. A growing number of States require both CPA's and licensed public accountants to complete a certain number of hours of continuing education courses before their licenses can be renewed. An increasing number of accountants study computer operation and programming to adapt accounting procedures to new data processing methods. Although capable accountants should advance rapidly, those having inadequate academic preparation may be assigned routine jobs and find promotion difficult.

Junior public accountants usually start by assisting with auditing work for several clients. They may advance to intermediate positions with more responsibility in 1 or 2 years and to senior positions within another few years. In larger firms, those who deal successfully with top industry executives often become supervisors, managers, or partners, or transfer to executive positions in private firms. Some open their own public accounting offices.

Beginning management accountants often start as ledger accountants, junior internal auditors, or as trainees for technical accounting positions. They may advance to jobs such as chief plant accountant, chief cost accountant, budget director, or manager of internal auditing. Some become controllers, treasurers, financial vice-presidents, or corporation presidents. In the Federal Government, beginners are hired as trainees and usually are promoted in a year or so. In college and university teaching, those having minimum training and experience may receive the rank of instructor without tenure; advancement and permanent faculty status depend upon further education and teaching experience.

Employment Outlook

Employment is expected to increase about as fast as the average for all occupations through the mid-1980's as businesses and governme[illegible] agencies continue to expand in size and complexity. In addition to jobs resulting from growth, many thousands of openings will result each year when workers die, retire, or leave the occupation.

Demand for skilled accountants will rise as managers rely more on accounting information to make business decisions. For example, officers of large corporations base their decisions concerning proposals such as plant expansion, mergers, or foreign investments on information about the financial condition of the firm, tax implications of the proposed action, and other considerations. On a smaller scale, owners of small businesses are expected to rely more and more on the expertise of public accountants in planning their operations. Government legislation to monitor business activity also is expected to add to the demand for accountants. An example is the Pension Reform Act of 1974, which establishes minimum standards for private pension plans. This and other legislation should create many new jobs for management accountants to maintain new systems and public accountants to audit them.

Because of the growing complexity of business, college graduates will be in greater demand than applicants who lack this training. Many employers prefer graduates who have worked part time in a business or accounting firm while in school. Those who have been trained in a specific phase of accounting should find ample opportunities.

As data processing systems continue to replace manual preparation of accounting records and statements, the need for some accountants to perform routine tasks, particularly in large firms, may be reduced. However, many opportunities will arise for accountants without a college degree, mainly in small businesses and public accounting firms.

Earnings and Working Conditions

Starting salaries of beginning accountants in private industry were $11,500 a year in 1976, according to a survey in urban areas. Earnings of

experienced accountants ranged between $15,400 and $23,400, depending on their level of responsibility and the complexity of the accounting system. In general, experienced accountants earn about twice as much as nonsupervisory workers in private industry, except farming. Chief accountants who direct the accounting program of a company or one of its establishments earned between $20,500 and $33,900, depending upon the scope of their authority and size of professional staff.

According to the same survey, beginning auditors averaged $11,800 a year in 1976, while experienced auditors' earnings ranged between $16,100 and $20,000.

In the Federal Civil Service, the entrance salary for junior accountants and auditors was about $9,300 in 1977. Candidates who had a superior academic record received a starting salary of about $11,500. Applicants with a master's degree or 2 years' professional experience began at about $14,100. Accountants in the Federal Government averaged about $21,800 a year in 1977.

Accountants who specialize in income tax preparation work long hours under heavy pressure during the tax season; those employed by national accounting firms may travel extensively to conduct audits and perform other services for their clients. The majority, however, work in one office between 35 and 40 hours a week, under the same general conditions as fellow office workers.

Sources of Additional Information

Information about CPA's and about aptitude tests in high schools, colleges, and public accounting firms may be obtained from:

American Institute of Certified Public Accountants, 1211 Avenue of the Americas, New York, N.Y. 10036.

Further information on specialized fields of accounting is available from:

National Association of Accountants, 919 Third Ave., New York, N.Y. 10022.

National Society of Public Accountants, 1717 Pennsylvania Ave. NW., Washington, D.C. 20006.

Institute of Internal Auditors, 249 Maitland Ave., Altamonte Springs, Fla. 32701.

ADVERTISING WORKERS

(D.O.T. 050.088; 132.088; 141.061 and .168; 162.158; and 164.068 through .168)

Nature of the Work

Almost every business, from a small grocery store to a large bank, does some form of advertising to pursuade people to buy its products or use its services. Advertising requires the talents of people in many different kinds of jobs. Creative workers such as writers, artists, and designers develop and produce advertisements, while people with business and sales ability handle the arrangements for broadcasting the advertisements on radio and television, publishing them in newspapers or magazines, mailing them directly, or posting them on billboards. The following occupations are those most commonly associated with advertising.

Advertising managers direct the advertising program of the businesses for which they work. They determine the size of the advertising budget, the type of ad and the media to use, and what advertising agency, if any, to employ. Managers who decide to employ an agency work closely with the advertising specialists from the agency. These managers may supervise the preparation of pamphlets, brochures, or other materials developed to promote the firm's products or services. Advertising managers working for newspapers, radio stations, and other communications media have somewhat different duties. They are responsible for selling advertising time or space, and do work that is similar to the work of sales managers in other businesses.

Account executives are employed by advertising agencies to develop advertising programs for client firms and individuals. They first study the client's sales, public image, and advertising problems, and then create a program that suits the client's needs. In most agencies, artists and copywriters are responsible for developing the actual artwork and advertising copy, but in some small agencies, the account executives have this responsibility.

Research directors and their assistants study the market. They review possible uses for the product or service being sold, compare its advantages or disadvantages with those of competitors, and suggest ways of reaching potential buyers. To develop market information, these workers may survey buying habits and motives of customers, or try out sample ads to find the theme or medium that best sells the product. (See the statement on marketing research workers for more information on this occupation.)

Advertising copywriters develop the headlines and text to be used in the ads. By studying information about the product and its potential customers, they are able to write copy aimed at the particular group of customers the advertiser seeks to attract. They may specialize in writing copy for a certain group of people, such as business managers, teenagers, or sports lovers, or for a class of products, such as cars or computer equipment. Copywriters usually work closely with account executives. In some agencies, they may be supervised by copy chiefs.

Artists and *layout workers* create the visual impact of an ad by selecting photographs, drawing illustrations or figures, and selecting the size or type of print to be used in a magazine or newspaper ad. When television commercials are planned, they usually sketch sample scenes for the client to consider. (See the statements on commerical artists and photographers for more information on this type of work.)

Media directors (or *space buyers* and *time buyers*) negotiate contracts for advertising space or air time. They determine the day and time when a television commercial will reach the largest group of prospective buyers at the lowest cost. To select the best medium for the advertiser, media directors must know the costs of using various media and the characteristics of the audience reached by specific publications or television stations.

Production managers and their assistants arrange to have the ad printed for publication, filmed for television, or recorded for radio. They

must know which firms or freelance workers will be able to produce the best ad for the least cost.

Places of Employment

In 1976, about 180,000 people worked in jobs requiring considerable knowledge of advertising. Those employed in advertising agencies were heavily concentrated in New York City, Los Angeles, and Chicago.

Many others worked in the advertising departments of manufacturing firms, retail stores, banks, power companies, professional and trade associations, and many other organizations. Some people had advertising jobs with television or radio stations, newspapers, and magazines. Still other people in the advertising field worked for printers, art studios, letter shops, package design firms, and similar businesses.

Training, Other Qualifications, and Advancement

Most employers prefer college graduates. Some employers seek persons with degrees in advertising with heavy emphasis on marketing, business, and journalism; others prefer graduates with a liberal arts background (social science, literature, art, and other disciplines); some employers place little emphasis on the type of degree.

No particular educational background is equated with success in advertising. In fact, relevant work experience may be more important than educational background. Experience selling ads for school publications or radio stations, or on a summer job with a marketing research service, can be a distinct advantage to the jobseeker.

Some organizations recruit outstanding college graduates for training programs that cover all aspects of advertising work. In other firms, employees immediately enter a specialty and do not gain such all-round experience. Some beginners start as research or production assistants or as space or time buyers. A few begin as junior copywriters.

Many advertising jobs require imagination, creativity, and a flair for language. These traits are especially important to artists, layout workers, and account executives. All creative effort must be directed toward the sales function. People interested in becoming advertising managers, account executives, media buyers, and production managers must be able to get along well with people and be able to sell their ideas. Research directors and their assistants must have an understanding of human behavior. All advertising workers must be able to accept criticism of their work and be able to function as part of a team.

Opportunities for advancement in this field generally are excellent for creative, talented, and hard-working people. For example, copywriters and account executives may advance to more responsible work in their specialties, or to managerial jobs, if they demonstrate ability in dealing with clients. Some especially capable workers may become partners in an existing agency, or they may establish their own agency.

Employment Outlook

Employment of advertising workers is expected to increase faster than the average for all occupations through the mid-1980's. Most openings, however, will result from the need to replace workers who die, retire, or leave the occupation for other reasons.

The growing number of consumer and industrial goods and increasing competition in many product and service markets will cause advertising expenditures to rise. Such expenditures also may be spurred by the growing tendency toward self service in retail marketing. An additional factor is the growing need of small businesses for professional advertising services. Employment in advertising occupations is strongly affected by general business conditions because firms expand or contract their advertising budgets according to their financial success. Although opportunities should be favorable for highly qualified applicants, particularly in retail advertising, others seeking entry jobs will face keen competition because the glamorous nature of the field attracts many people.

Local television, radio, and newspapers are expected to increase their share of total advertising expenditures while direct mail, magazines, and national newspapers continue to lose ground. The few very large agencies that account for nearly all national advertising are expected to maintain fast growth because of their expanding international business.

Advertising can be a satisfying career for persons who enjoy variety, creative challenges, and competition.

Earnings and Working Conditions

Based on limited information, annual salaries for beginning advertising workers with bachelor's degrees ranged from $8,000 to $10,000 in 1976. Higher starting salaries generally were paid by the largest firms or advertising agencies to outstanding applicants, particularly those with advertising experience.

Salaries of experienced advertising workers varied by size and type of firm as well as by type of job. According to a survey of advertising agencies taken in 1975, average annual salaries of workers in selected occupations were as follows: Chief executive officer, $45,300; account supervisor, $28,400; account executive, $18,500; executive art director, $24,400; art director, $17,100; senior layout artist, $12,900; junior layout artist, $9,300; copy chief, $22,300; senior copywriter, $16,600; junior copywriter, $10,500; media director, $16,800; space or time buyer, $9,400; research director, $24,000; research analyst, $13,500; production manager, $14,400. Several other surveys yielded these results: In 1976, the top advertising officers in large retail firms averaged over $32,000 a year; in 1975, the median salary of advertising directors in large banks ranged from $16,000 to $17,000 a year; in 1975, the average salary of advertising managers in a wide variety of companies ranged from $18,000 to $34,000 a year, depending upon the annual sales volume of the firm. Salaries of advertising managers generally are higher in consumer than industrial products firms, and many receive incentive compensation.

People in advertising work under great pressure, and do not have the job security enjoyed by workers in many other occupations. These workers are expected to produce quality ads in as short a time as possible. Sometimes they must work long or irregular hours to meet deadlines or make last-minute changes. Account executives, copywriters, and layout workers may become frustrated by a client's inability to define the type of ad he or she wants for a product.

Advertising can be a satisfying career for persons who enjoy variety, excitement, creative challenges, and competition. Unlike workers in many other occupations, advertising workers experience the satisfaction of having their work in print, on television, or on radio, even though they remain unknown to the public at large.

Sources of Additional Information

Information on advertising agencies and the careers they offer is available from:

American Association of Advertising Agencies, 200 Park Ave. New York, N.Y. 10017.

For additional information on careers and a list of colleges that provide training in advertising, contact:

American Advertising Federation, 1225 Connecticut Ave. NW., Washington, D.C. 20036.

BUYERS

(D.O.T. 162.158 and 185.168)

Nature of the Work

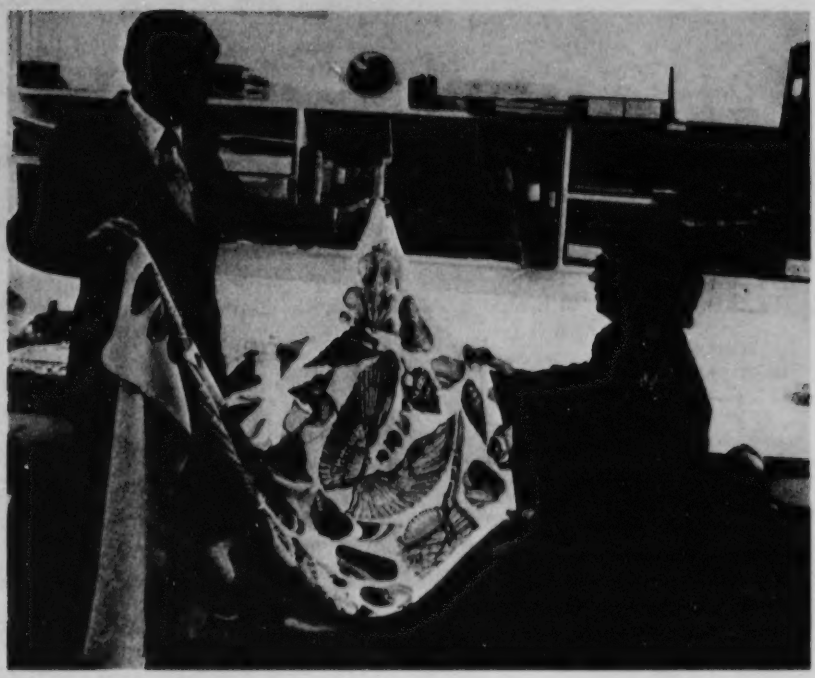
The Americans have been invited to a private showing in Paris. Representing a major New York department store, they sit with a select group in an elegantly furnished room. They watch closely as graceful models float down the runway before them to display the latest creations by the world's most famous designers. After some consultation, they make choices involving thousands, perhaps millions of dollars. All in a day's work.

The job of retail buyer often brings to mind the glamour of high fashion; indeed, many fashion buyers do lead exciting, fast-paced lives involving frequent travel abroad. Not every buyer, however, deals in fashion. All merchandise sold in a retail store—garden furniture, automobile tires, toys, aluminum pots, and canned soups alike—appears in that store on the decision of a buyer. Although all buyers seek to satisfy their stores' customers and sell at a profit, the kind and variety of goods they purchase depend on the store where they work. A buyer for a small clothing store, for example, may purchase its complete stock of merchandise from sportswear to formal evening clothes. Buyers who work for larger retail businesses often handle one or a few related lines of goods, such as men's wear, ladies' sportswear, or children's toys. Some, known as *foreign buyers*, purchase merchandise outside the United States.

In order to purchase the best selection of goods for their stores, buyers must be familiar with the manufacturers and distributors who handle the merchandise they need. They also must keep informed about changes in existing products and the development of new ones. To learn about merchandise, buyers attend fashion and trade shows and visit manufacturers' showrooms. They usually order goods during buying trips, and also place orders with wholesale and manufacturers' sales workers who call on them to display their merchandise.

Buyers must be able to assess the resale value of goods after a brief inspection and make a purchase decision quickly. They are aware of their stores' profit margins and try to select merchandise that will sell quickly at well above the original cost. Since most buyers work within a limited budget, they must plan their purchases to keep needed items always in stock but also allow for unexpected purchases when a "good buy" presents itself.

Because buyers purchase merchandise for their firms to resell (unlike purchasing agents who buy goods for direct use by the firm—see the statement on purchasing agents elsewhere in the *Handbook*), they must know what motivates customers to buy. Before ordering a particular line of merchandise, buyers study market research reports and analyze past sales records to determine what products are currently in demand. They also work closely with assistant buyers and sales clerks whose daily contact with customers furnishes information about consumer likes and dislikes. In addition, buyers read fashion and trade magazines to keep abreast of style and manufacturing trends; follow ads in newspapers and



Buyer in a large department store discusses quality of merchandise with manufacturer's representative.

other media to check retail competitors' sales activities; and watch general economic conditions to anticipate consumer buying patterns.

Merchandise managers (D.O.T. 185.168) plan and coordinate buying and selling activities for large and medium-sized stores. They divide the budget among buyers, decide how much merchandise to stock, and assign each buyer to purchase certain goods. Merchandise managers may review buying decisions to insure that needed categories of goods are in stock, and help buyers to set general pricing guidelines.

Buyers and merchandise managers usually have very busy schedules and deal with many different people in the course of a day. They work with manufacturers' representatives, other store personnel including store executives and sales workers, and customers. Assisting with sales promotions and creating enthusiasm among sales personnel are part of the buyer's job, and he or she may be asked to provide information such as dress sizes and product descriptions to the advertising department for a sales promotion, or to meet with floor sales workers before a new line of merchandise is introduced. Some buyers direct assistants who handle routine aspects of purchasing such as verifying shipments; others supervise department managers.

Some buyers represent large stores or chains in cities where many manufacturers are located. The duties of these "market representatives" vary by employer; some purchase goods, while others supply information and arrange for store buyers to meet with manufacturers when they are in town.

New technology has altered the buyer's role in retail chain stores. In the past, firms employed a buyer for each store or group of stores in a local area. Now cash registers connected to a computer, known as point-of-sale terminals, allow retail chains to maintain centralized, up-to-the-minute inventory records. With these records, a single garden furniture buyer, for example, can purchase lawn chairs and picnic tables for the entire chain.

Places of Employment

In 1976, approximately 109,000 buyers and merchandise managers worked for retail firms. Although jobs for buyers are found in all parts of the country, most jobs are in major metropolitan areas where retail stores are concentrated. Market representatives work for buying offices in major market areas such as New York, Chicago, and Dallas.

Training, Other Qualifications, and Advancement

Distributive education programs at thousands of high schools have launched careers in retailing leading to a buyer's position. (Additional information on distributive education appears in the statement on retail trade sales workers elsewhere in the *Handbook*.) Indeed, many a good buyer began in a stockroom or behind a counter and worked up the ladder without any college training. However, new buyers will find a college degree increasingly necessary. Many junior and 4-year colleges offer programs in marketing and purchasing and confer thousands of degrees each year. In addition, numerous trade schools train students for careers in fashion merchandising. Courses in merchandising or marketing may help in getting a first job, but most employers accept graduates in any field of study and train them on the job.

Many stores, especially the larger ones, have formal training programs for management or executive trainees, including buyers. These programs usually last from 6 to 8 months and combine classroom instruction in merchandising and purchasing with short rotations to various jobs in the store. This training introduces the new worker to store operations and policies, and provides the fundamentals of merchandising and management as well.

The trainee's first job is likely to be that of assistant buyer. The duties include supervising sales workers, checking invoices on material received, and keeping account of stock on hand. Assistant buyers gradually assume purchasing responsibilities, depending upon their individual abilities and the size of the department where they work. Training as an assistant buyer usually lasts at least a year. After years of working as a buyer, those who show exceptional ability may advance to merchandise

manager. A few find further promotion to top executive jobs such as general merchandise manager for a retail store or chain. The length of time it takes to reach any of these levels depends not just on the individual's ability but on the store's need for management personnel. The faster the company grows, the greater the opportunity for a worker to acquire responsibility.

Buyers should be good at planning and decisionmaking and have an interest in merchandising. They need leadership ability and communications skills to supervise sales workers and assistant buyers and to deal effectively with manufacturers' representatives and store executives. Because of the fast pace and constant pressure of their work, buyers need physical stamina and emotional stability.

Employment Outlook

Employment of buyers is expected to grow more slowly than the average for all occupations through the mid-1980's. Centralized buying is gaining popularity among chain stores, which are expected increasingly to dominate general merchandise retailing. Although anticipated growth of independent food stores should partially offset these trends, they will still reduce the number of openings for buyers. Most job openings will arise each year from the need to replace workers who leave the occupation. Competition for these jobs is expected to be keen, for merchandising attracts large numbers of college graduates every year. Prospects are likely to be best for qualified applicants who enjoy the competitive nature of retailing and work best in a demanding, fast-paced job.

Earnings and Working Conditions

Buyers for discount department stores and other mass merchandising firms are among the most highly paid in the industry, as are those who buy centrally for large chain department stores. Most earned between $15,000 and $25,000 a year in 1976, though many earned salaries outside this range. Merchandising managers earned considerably more. The actual income depends upon the product line purchased, the sales volume of the store, and the individual's seniority.

Buyers often earn large bonuses for exceptional performance. In addition, many stores have incentive plans, such as profit sharing and stock options.

Buyers regulate their own hours, and often work more than 40 hours a week because of special sales, conferences, and travel. The amount of traveling a buyer does varies with the type of merchandise bought and the location of suppliers, but most spend 4 or 5 days a month on the road. Merchandise managers also travel frequently, averaging several trips a month in many cases.

Sources of Additional Information

General information about a career in retailing is available from:

National Retail Merchants Association, 100 West 31st St., New York, N.Y. 10001.

Information on schools that teach retailing is available from:

United States Office of Education, Division of Vocational/Technical Education, Washington, D.C. 20202.

National Association of Trade and Technical Schools, 2021 L St. NW., Washington, D.C. 20036.

CITY MANAGERS

(D.O.T. 188.118 and 188.168)

Nature of the Work

Population growth and industrial expansion place increasing pressure on housing, transportation, and other facilities of cities. Problems associated with growing modern communities, such as air and water pollution and rising crime rates, also demand attention. To cope effectively with these problems, many communities hire a specialist in management techniques—the city manager.

A city manager usually is appointed by the community's elected officials and is responsible directly to

A city manager often deals with members of the community.

them. Although duties vary by city size, city managers generally administer and coordinate the day-to-day operations of the city. They are responsible for functions such as tax collection and disbursement, law enforcement, and public works. They also hire department heads and their staffs and prepare the annual budget to be approved by elected officials. In addition, they study current problems, such as traffic congestion, crime, or urban renewal, and report their findings to the elected council.

City managers must plan for future growth and development of cities and surrounding areas. To provide for an expansion of public services, they frequently appear at civic meetings to advocate certain programs or to inform citizens of current government operations.

City managers work closely with planning departments to coordinate new and existing programs. In smaller cities that have no permanent planning staff, coordination may be done entirely by the manager.

To aid the city manager, many cities employ *management assistants*: assistant city managers, department head assistants, and administrative assistants. Under the manager's direction, management assistants administer programs, prepare reports, receive visitors, answer correspondence, generally help to keep the city government functioning smoothly. Assistant city managers organize and coordinate city programs, supervise city employees, and act for the city manager upon occasion. They also may assume responsibility for some projects, such as the development of a preliminary annual budget. Department head assistants generally are responsible for one activity, such as personnel, finance, or law enforcement, but they also may assist in other areas. Administrative assistants, also called executive assistants or assistants to the city manager, usually do administrative and staff work in all departments under the city manager. For instance, they may compile operating statistics or review and analyze work procedures.

Places of Employment

About 3,000 city managers were employed in 1976. In addition, nearly 9,000 persons worked as administrative assistants, department head assistants, and assistant city managers. Most city managers worked for cities and counties that had a council-manager form of government. Under this type of government, an elected council appoints a manager who is responsible for the day-to-day operation of the government as well as for the hiring and firing of assistants, department heads, and other staff. Many other city managers worked for municipalities that had the mayor-council form of government, in which the mayor appoints the city manager as his or her chief administrative officer. A few city managers also worked for county governments, metropolitan or regional planning organizations, and councils of governments. All types of local governments employed management assistants, but larger jurisdictions generally employed them in greater numbers.

Although over three-quarters of all city managers work for small cities having less than 25,000 inhabitants, many larger cities also employ a city manager. About half of the cities having a population of between 10,000 and 500,000 have city managers. City managers work in all States, but one-half are concentrated in the eastern part of the Nation.

Training, Other Qualifications, and Advancement

A master's degree, preferably in public or business administration, is becoming essential for those seeking a career in city management. Although some applicants with only a bachelor's degree may find employment, strong competition for positions, even among master's degree recipients, will make the graduate degree a requirement for most entry level jobs. In some cases, employers may hire a person with training in a field related to public administration, such as engineering, recreation, social work, or political science.

In 1976, 185 colleges and universities offered graduate degree programs in public or municipal administration. Degree requirements in some schools include successful completion of an internship program in a city manager's office. During this internship period, which may last from 6 months to a year, the degree candidate observes local government operations and does research under the direct supervision of the city manager.

Nearly all city managers begin as management assistants. Most new graduates work as administrative assistants to city managers for several years to gain experience in solving urban problems, coordinating public services, and applying management techniques. Others work in a government department such as finance, public works, or public planning. They may acquire supervisory skills and additional experience by working as assistant city manager or department head assistant. City managers often are first employed in small cities, but during their careers they may work in several cities of increasing size.

Persons who plan a career in city management should like to work with detail and to be a part of a team. They must have sound judgment, self-confidence, and the ability to perform well under stress. To handle emergency situations, city managers must quickly isolate problems, identify their causes, and provide a number of possible solutions. City managers should be tactful and able to communicate and work well with people.

City managers also must be dedicated to public service since they often put in long, hard hours in times of crisis.

Employment Outlook

Employment of city managers and local government management assistants is expected to expand faster than the average for all occupations through the mid-1980's as management of our governments becomes more complex. Examples of more sophisticated management techniques include computerized tax and utility billing, electronic traffic control, and application of systems analysis to urban problems. The demand for city managers also will increase as more cities convert to the council-manager form of government, currently the fastest growing form of city government. Furthermore, city managers and management assistants will be

employed by other types of local government to help elected officials with day-to-day operations of government. Increased emphasis on regional solutions to urban problems should result in additional job opportunities for city managers and management assistants in councils of government.

Persons who seek beginning management assistant jobs may face strong competition through the mid-1980's, especially if they do not have a graduate degree in public administration or related management experience. Competition should be keen among the growing number of administrative assistants, department head assistants, and assistant city managers for the relatively few city manager positions. However, many of those unable to find employment in this area should find jobs in other fields of public administration.

Earnings and Working Conditions

Salaries of city managers and management assistants vary according to education, experience, job responsibility, and city size. Generally, city managers' earnings are very high relative to the average earnings for nonsupervisory workers in private industry, except farming. In 1976, average annual salaries of city managers ranged from about $20,000 in cities of 5,000 inhabitants to more than $40,000 in cities of over 100,000 inhabitants, according to the International City Management Association. The average annual salary for all city managers was more than $23,000. City managers in cities not having council-manager governments received slightly less.

Salaries of management assistants averaged $17,000 in 1976, and ranged from about $12,000 in small cities to more than $20,000 in large ones. Salaries of assistant city managers generally were higher than those of other management assistants.

City managers often work more than 40 hours a week. Emergency problems may require evening and weekend work and meetings with individuals and citizen's groups consume additional time.

Fringe benefits usually include health and life insurance programs, pension plans, sick leave, vacation time, and often a car for official business. Managers generally are reimbursed for expenses incurred while attending professional meetings and seminars.

Sources of Additional Information

For information on a career in city management, contact:

International City Management Association, 1140 Connecticut Ave. NW., Washington, D.C. 20036.

COLLEGE STUDENT PERSONNEL WORKERS

(D.O.T. 045.108, 090.118 and .168, 129.108, and 166.168)

Nature of the Work

A student's choice of a particular institution of higher education is influenced by many factors. Availability of a specific educational program, quality of the school, cost, and location all may play important roles.

For many students, however, an equally important factor is the institution's ability to provide for their housing, social, cultural, and recreational needs. Developing and administering these services are the tasks of college student personnel workers. The admissions officer, the registrar, the dean of students, and the career planning and placement counselor are probably the best known among these. Other workers that make up this broad occupational field include student activities and college union personnel, student housing officers, counselors in the college counseling center, financial aid officers, and foreign student advisers.

Titles of student personnel workers vary from institution to institution and from program to program within a single school. Titles also vary with the level of responsibility within a student personnel program. The more common titles include dean, director, officer, associate dean, assistant director, and counselor.

The *dean of students*, or the vice president for student affairs, heads the student personnel program at a school. Among his or her duties are evaluating the changing needs of the students and helping the president of the college develop institutional policies. For example, to meet the needs of an increasing number of older, part-time students, colleges and universities have been changing policies in areas such as student housing and student participation in decisions on graduation requirements and course offerings. In addition, the dean of students generally coordinates a staff

Student financial aid personnel help students obtain financial support for their education.

of associate or assistant deans who are in charge of the specific programs that deal directly with the students.

At some schools, the admissions office and the records office are separate. *Admissions counselors* interview and evaluate prospective students and process their applications. They may travel extensively to recruit high school, junior college, and older students and to acquaint them with opportunities available at their college. They work closely with faculty, administrators, financial aid personnel, and public relations staff to determine policies for recruiting and admitting students. Personnel in the office of the *registrar* maintain the academic records of students and provide current enrollment statistics to those who require them both within the college and in the community.

Student financial aid personnel help students obtain financial support for their education. Workers in this field must keep well-informed about the sources and management of all forms of financial aid—scholarships, grants, loans, employment, fellowships, and teaching and research assistantships. They work closely with administrators and the admissions, counseling, business, and academic office staffs.

Career planning and placement counselors, sometimes called college placement officers, assist students in career selections and also may help them get part-time and summer jobs. On many campuses, they arrange for prospective employers to visit the school to discuss their personnel needs and to interview applicants. (For further information on this field, see statement on college career planning and placement counselors.)

The student personnel staff in charge of *student activities* work with members of proposed and established student organizations, especially with student government. They help the student groups to plan, implement, and evaluate their activities. Often, the student activities staff will assist in the orientation of new students.

College union staff members work with students to provide intellectual, cultural, and recreational programs. Many college union staff members direct the operation of the physical facilities and services of the building, such as food and recreational services, building maintenance, fiscal planning, and conference facilities.

Student housing officers sometimes live in the dormitories and, in general, help the students to live together in harmony. They may serve as counselors to individual students with personal problems. Housing officers also may be involved in managing the fiscal, food service, and housekeeping operations of student residences.

Counselors help students with personal, educational, and vocational problems. Students may come to the counselors on their own or be referred by a faculty member, a residence hall counselor, or a friend. Counseling needs may arise from lack of self-confidence or motivation on the part of the student, failure in academic work, desire to leave college or transfer to another college, inability to get along with others, loneliness, drug abuse, or marriage problems. In addition, there is a growing trend for counselors to try to reach more students by establishing group sensitivity sessions and telephone "hotlines." Counselors often administer tests that indicate aptitudes and interests to students having trouble understanding themselves. Some also teach in the college or assist with admissions, orientation, and training of residence hall staff. (For further information on this field, see statement on psychologists.)

Foreign student advisers administer and coordinate many of the services that help to insure a successful academic and social experience for students from other countries. They usually assist with foreign student admissions, orientation, financial aid, housing, English as a foreign language, academic and personal counseling, student-community relationships, job placement, and alumni relations. In addition, they may be an adviser for international associations and nationality groups and for U.S. students interested in study, educational travel, work, or service projects abroad.

Places of Employment

An estimated 57,000 college student personnel workers were employed in 1976. Every college and university, whether a 2-year or a 4-year school, has a staff performing student personnel functions. They are not always organized as a unified program. Large colleges and universities generally have specialized staffs for each personnel function. In many small colleges a few persons may carry out the entire student personnel program.

Training, Other Qualifications, and Advancement

Because of the diversity in duties, the education and backgrounds of college student personnel workers vary considerably. Generally, however, a master's degree is preferred and a doctoral degree may be necessary for advancement to top-level positions. Schools often prefer persons with a bachelor's degree in a social science, such as economics or history, and a master's degree in student personnel work. In 1976, 120 colleges and universities offered graduate programs in this area.

Other specialized training may also be required for some student personnel occupations. A master's degree in clinical or counseling psychology usually is required for work as a college counselor. This degree also is helpful in other student personnel fields such as career planning and placement. Familiarity with data processing is an asset, especially for work in admissions, records, or financial aid. Social science and recreation degrees also are useful, as is work experience in business, government, or educational associations.

College student personnel workers must be interested in, and able to work with, people of all backgrounds and ages. They must have the patience to cope with conflicting viewpoints of students, faculty, and parents. People in this field often deal with the unexpected and the unusual; therefore emotional stability and the ability to function while under pressure are necessities.

Entry level positions usually are those of student activities advisers, admissions counselors, financial aid

counselors, residence hall directors, and assistants to deans. Persons without graduate degrees may find advancement opportunities limited. A doctorate usually is necessary for the top student personnel positions.

Employment Outlook

The employment outlook for college student personnel workers is likely to be somewhat competitive through 1985. Tightening budgets in both public and private colleges and universities, are expected to limit growth in employment. Student personnel positions least likely to be affected if some reduction becomes necessary are those in admissions, financial aid, and records. Most openings will result from the need to replace personnel who transfer to other positions, retire, or leave the field for other reasons.

Any employment growth that does occur is expected to be in junior and community colleges. Enrollment at this level of education has been rising and many new schools have opened. If these recent trends continue, some additional student personnel workers will be needed in 2-year institutions.

Earnings and Working Conditions

Salaries vary greatly depending on geographic location and the size of the school. According to the limited data available, top administrators with at least 5 years of experience averaged between $28,000 and $30,000 a year in 1976. In the larger colleges and universities, salaries reached as high as $46,000.

College student personnel workers frequently wok more than a 40-hour week; often irregular hours and overtime work are necessary. Employment in these occupations usually is on a 12-month basis. In many schools, they are entitled to retirement, group medical and life insurance, and sabbatical and other benefits.

Sources of Additional Information

A pamphlet, *Careers in Higher Education*, is available from:

The American Personnel and Guidance Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

CREDIT MANAGERS

(D.O.T. 168.168)

Nature of the Work

Both businesses and individuals may require credit (the postponement of payment until a future date) to meet their daily needs for a variety of goods and services. For most forms of credit, a credit manager has final authority to accept or reject a credit application.

In extending credit to a business (commercial credit), the credit manager, or an assistant, analyzes detailed financial reports submitted by the applicant, interviews a representative of the company about its management, and reviews credit agency reports to determine the firm's record in repaying debts. The manager also checks at banks where the company has deposits or previously was granted credit. In extending credit to individuals (consumer credit), detailed financial reports usually are not available. The credit manager must rely more on personal interviews, credit bureaus, and banks to provide information about the person applying for credit.

Particularly in large organizations, executive level credit managers are responsible for formulating a credit policy. They must establish financial standards to be met by applicants and thereby determine the amount of risk that their company will accept when offering its products or services for sale on credit. Managers usually cooperate with the sales department in developing a credit policy liberal enough to allow the company's sales to increase and yet strict enough to deny credit to customers whose ability to repay their debts is questionable. Many credit managers establish office procedures and supervise workers who gather information, analyze facts, and perform general office duties in a credit department; they include application clerks, collection workers, bookkeepers, and secretaries.

In smaller companies that handle a limited number of accounts, credit managers may do much of the work of granting credit themselves. They may interview applicants, analyze the information gained in the interview, and make the final approval. They frequently must contact customers who are unable or refuse to pay their debts. They do this through writing, telephoning, or personal contact. If these attempts at collection fail, credit managers may refer the account to a collection agency or assign an attorney to take legal action.

Places of Employment

About 53,000 persons worked as credit managers in 1976. About one-half were employed in wholesale and retail trade, but many others, about one-third of the total, worked for manufacturing firms and financial institutions.

Although credit is granted throughout the United States, most credit managers work in urban areas where many financial and business establishments are located.

Training, Other Qualifications, and Advancement

A college degree is becoming increasingly important for entry level jobs in credit management. Employers usually seek persons who have majored in business administration, economics, or accounting, but may also hire graduates holding liberal arts degrees. Some employers promote high school graduates to credit manager positions if they have experience in credit collection or processing credit information.

Newly hired workers normally begin as management trainees and work under the guidance of more experienced personnel in the credit department. Here they gain a thorough understanding of the company's credit procedures and policies. They may analyze previous credit transactions to learn how to recognize which applicants should prove to be good customers. Trainees also learn to deal with credit bureaus, banks, and other businesses that can provide information on the past credit dealings of their customers.

A college degree is becoming increasingly important for entry level jobs in credit management.

Many formal training programs are available through the educational branches of the associations that serve the credit and finance field. This training includes home study, college and university programs, and special instruction to improve beginners' skills and keep experienced credit managers aware of new developments in their field.

A person interested in a career as a credit manager should be able to analyze detailed information and draw valid conclusions based on this analysis. Because it is necessary to maintain good customer relationships, a pleasant personality and the ability to speak and write effectively also are characteristics of the successful credit manager.

The work performed by credit managers allows them to become familiar with almost every phase of their company's business. Highly qualified and experienced managers can advance to top-level executive positions. However, in small and medium-sized companies, such opportunities are limited.

Employment Outlook

Through the mid-1980's employment is expected to grow more slowly than the average for all occupations. Despite this relatively slow growth, many jobs will become available each year due to the need to replace persons who leave the occupation. Although there will be opportunities throughout the country, employment prospects should continue to be best for well-qualified jobseekers in metropolitan areas.

The volume of credit extended rose very rapidly during the past decade. In the years ahead, businesses can be expected to require increasing amounts of credit to secure raw materials for production and obtain finished goods for eventual resale. It is in the area of business credit where demand for credit managers will be strongest.

Consumers, whose personal incomes have risen, are expected to finance greater numbers of high-priced items. In addition, the use of credit for everyday purchases is expected to grow as demand increases for recreation and household goods as well as for consumer services. Despite increases in consumer debt, the use of computers for storing and retrieving information will enable this greater volume of information to be processed more efficiently. The use of telecommunications networks enables retail outlets to have immediate access to a central credit office, regardless of distance.

Another factor that is expected to slow the growth in the number of credit managers is the increased use of bank credit cards. As stores substitute bank credit cards for their own charge accounts, credit departments may be reduced or eliminated.

Earnings and Working Conditions

In 1976, credit manager trainees who had a college degree earned annual salaries that ranged from about $10,000 to $11,000, depending on the type of employer and the geographic location of the job.

Assistant credit managers averaged about $12,000 to $14,000 a year and credit managers had average earnings of about $17,000. Individuals in top-level positions often earn over $40,000 a year.

Credit managers normally work the standard workweek of their company—35-40 hours, but some work longer hours. In wholesale and retail trade, for example, a seasonal increase in credit sales can produce a greater work volume. Some credit managers attend conferences sponsored by industry and professional organizations where managers meet to develop and discuss new techniques for the management of a credit department.

Sources of Additional Information

Information about a career in consumer credit may be obtained from:

International Consumer Credit Association, 375 Jackson Ave., St. Louis, Mo. 63130.

National Consumer Finance Association, 1000 16th St., NW., Washington, D.C. 20036.

For information about training programs available in commercial credit, write:

National Association of Credit Management, 475 Park Ave. South, New York, N.Y. 10016.

HOTEL MANAGERS AND ASSISTANTS

(D.O.T. 163.118 and 187.118, .168)

Nature of the Work

Hotel managers are responsible for operating their establishments profit-

ably and satisfying guests. They determine room rates and credit policy, direct the operation of the kitchen and dining rooms, and manage the housekeeping, accounting, and maintenance departments of the hotel. Handling problems and coping with the unexpected is an important part of the job.

Managers who work in small hotels may do much of the front office clerical work, such as taking room reservations and assigning rooms. In some small hotels and many motels, the manager is also the owner and may be responsible for all aspects of the business.

General managers of large hotels usually have several assistants who manage various parts of the operation. Because the hotel restaurant and cocktail lounge are important to the success of the entire establishment, they almost always are operated by managers with experience in the restaurant field. Other areas that usually are handled separately are advertising, rental of banquet and meeting facilities, personnel, and accounting.

Large hotel and motel chains often centralize some activities, such as purchasing and advertising, so that individual hotels in the chain may not need managers for these departments. Managers who work for chains may be assigned to organize a newly built or purchased hotel or to reorganize an existing hotel or motel that is not operating successfully.

General managers of large hotels usually have several assistants who manage various parts of the operation.

About 137,000 hotel and motel managers worked in 1976. More than a third were self-employed.

Training, Other Qualifications, and Advancement

Experience generally is the most important consideration in selecting managers. However, employers increasingly are emphasizing college education. A bachelor's degree in hotel and restaurant administration provides particularly strong preparation for a career in hotel management. In 1976, about 30 colleges and universities offered 4-year programs in this field. However, applicants to these programs may face increasing competition in the coming years. The courses in hotel work that are available in many junior colleges and technical institutes and through the American Hotel and Motel Association also provide a good background.

A college program in hotel management usually includes courses in hotel administration, accounting, economics, data processing, food service management and catering, and hotel maintenance engineering. Students are encouraged to work in hotels or restaurants during summer vacations because the experience gained and the contacts made with employers may help them to get better hotel jobs after graduation.

Managers should have initiative, self-discipline, and the ability to organize work and direct the work of others. They must be able to concentrate on details and solve problems.

Some large hotels have special on-the-job management trainee programs in which trainees rotate among various departments to acquire a thorough knowledge of the hotel's operation. Outstanding employees who have not had college training may receive financial assistance to help them acquire a degree.

Most hotels promote employees with proven ability, usually front office clerks, to assistant manager and eventually to general manager. Newly built hotels, particularly those without well-established on-the-job training programs, often prefer experienced personnel for managerial positions. Hotel chains may offer better opportunites for advancement than independent hotels, because employees can transfer to another hotel in the chain or to the central office if an opening occurs.

Employment Outlook

Employment of hotel managers is expected to grow more slowly than the average for all occupations through the mid-1980's. Some job openings will occur as additional hotels and motels are built and chain and franchise operations spread. However, most openings will occur as experienced managers die, retire, or leave the occupation. Applicants having college degrees in hotel administration will have an advantage in seeking entry positions and later advancement.

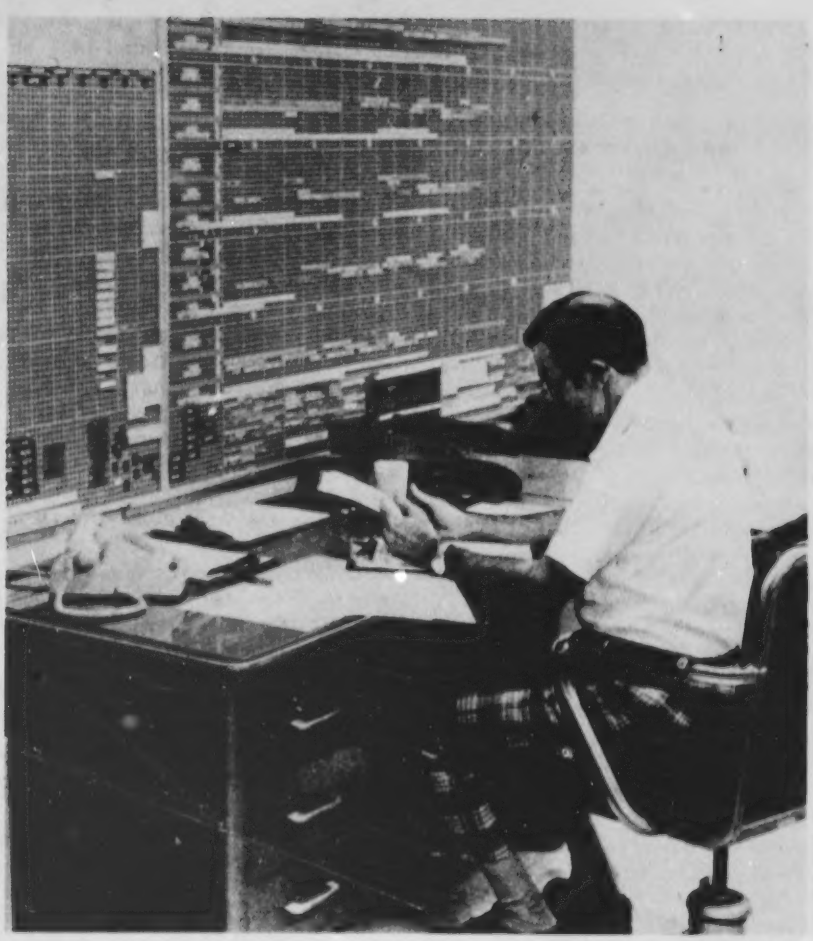
See the statement on the Hotel Industry elsewhere in the *Handbook* for information on earnings and working conditions, sources of additional information, and more information on employment outlook.

INDUSTRIAL TRAFFIC MANAGERS

(D.O.T. 184.168)

Nature of the Work

Industrial firms want to receive raw materials and deliver customers' goods promptly, safely, and with minimum cost. Arranging for the transportation of materials and finished products is the job of an industrial traffic manager. Industrial traffic managers analyze various transportation possibilities and choose the most efficient type for their companies' needs—rail, air, road, water, pipeline, or some combination. Then they select the route and the particular carrier. To make their decision, traffic managers consider factors such as freight classifications and regulations, freight charges, time schedules, size of shipments, and loss and damage ratios. (This statement does not cover traffic managers who sell transportation services for railroads, airlines, trucking firms, and other freight carriers.)



Industrial traffic managers arrange the transportation of materials and finished products.

Activities of industrial traffic managers range from checking freight bills to deciding whether the company should buy its own fleet of rail cars or trucks or contract for services. They route and trace shipments, arrange with carriers for transportation services, prepare bills of lading and other shipping documents, and handle claims for lost or damaged goods. Traffic managers keep records of shipments, freight rates, commodity classifications, and applicable government regulations. They also must stay informed about changing transportation technology.

Traffic managers often consult with other company officials about the firm's transportation needs. They may, for example, work with production department personnel to plan shipping schedules, or with members of the purchasing department to determine what quantities of goods can be transported most economically.

Since many aspects of transportation are subject to Federal, State, and local government regulations, traffic managers must know about these and any other legal matters that apply to their companies' shipping operations. High level traffic managers represent their companies before ratemaking and regulatory bodies such as the Interstate Commerce Commission, State commissions, and local traffic bureaus.

Places of Employment

More than 21,000 persons were involved in industrial traffic management in 1976. Although most jobs are found in manufacturing firms, some traffic managers work for wholesalers or for large retail stores. Some traffic managers work for consulting firms that handle transportation problems for clients; a few run their own consulting businesses.

Training, Other Qualifications, and Advancement

Although high school graduates with experience in traffic departments sometimes are hired as traffic managers, a college education is increasingly important in this field. For some kinds of work, college training is required. To argue cases before the Interstate Commerce Commission, for example, a traffic manager must meet standards that include at least 2 years of college. Some employers prefer graduates of technical and trade school programs in traffic management. Others seek college and university graduates who have either majored, or taken courses, in transportation, logistics, physical distribution, management, economics, statistics, marketing, computer science, and commercial law.

Industrial traffic training is available through colleges and universities, technical and trade schools, and seminars sponsored by professional associations. More than 100 colleges and universities offer programs or courses in traffic management. College courses in this field often are offered as part of a major program in business administration. In some colleges and universities, however, traffic management is taught in departments of logistics, transportation, or marketing and distribution. In addition to degree programs at the associate, baccalaureate, and graduate levels, a number of colleges and universities offer workshops, seminars, and other short-term programs in transportation and traffic management.

Industrial traffic managers should be able to analyze numerical and technical data such as freight rates and classifications to solve transportation problems. The job also requires the ability to work independently and to present facts and figures in a convincing manner.

Newly hired traffic specialists often complete shipping documents and calculate freight charges. After gaining experience, they do more technical work such as analyzing

transportation statistics. A competent worker may advance to a supervisory job such as supervisor of rates and routes; a few are promoted to assistant traffic manager and eventually to traffic manager. Industrial traffic managers can sometimes help their chances for advancement by participating in company-sponsored training programs or taking advanced courses in traffic management. A growing number are certified by the American Society of Traffic and Transportation, Inc.

Employment Outlook

Industrial traffic management is a relatively small occupation and is expected to grow about as fast as the average for all occupations through the mid-1980's. Openings will occur each year as new jobs are created, and as traffic managers die, retire, or leave the field for other reasons. College graduates with a major in traffic management or transportation can expect first consideration for the available jobs.

Growth in the occupation will stem from an increasing emphasis on reducing the cost of receiving raw materials and distributing finished products. As the distance between markets becomes greater and rate schedules and regulations governing transportation more complex, manufacturers increasingly will require the expertise of the traffic manager.

Earnings and Working Conditions

Industrial traffic specialists' salaries started at about $11,000 a year in 1976, according to the limited information available. Although earnings of experienced traffic managers vary, in general they are much higher than the average for all nonsupervisory workers in private industry, except farming. Some traffic executives earned $50,000 a year or more.

Although industrial traffic managers usually have a standard workweek, some of them have to spend time outside regular working hours preparing reports, attending meetings, and traveling to hearings before State and Federal regulatory agencies.

Sources of Additional Information

Answers to specific questions about a career in traffic management are available from:

American Society of Traffic and Transportation, Inc., 547 West Jackson Blvd., Chicago, Ill. 60606.

For a list of colleges, universities, and technical institutes that offer instruction in transportation and related areas, see: *Directory of Transportation Education*, published in 1976 by the U.S. Department of Transportation (Washington, D.C., U.S. Government Printing Office). The directory is available in many school and public libraries.

For a copy of the American Trucking Association's *Directory of Transportation Education in U.S. Colleges and Universities*, write:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

For information on proprietary schools that offer programs in traffic management, contact:

National Association of Trade and Technical Schools, 2021 L St. NW., Washington, D.C. 20036.

LAWYERS

(D.O.T. 110.108, .118, and 119.168)

Laws permeate every aspect of our society. They regulate the entire spectrum of relationships among individuals, groups, businesses, and governments. They define rights as well as restrictions, covering such diverse human activities as judging and punishing criminals, granting patents, drawing up business contracts, paying taxes, settling labor disputes, constructing buildings, and administering wills.

Because social needs and attitudes are continually changing, the legal system that regulates our social, political, and economic relationships also is subject to change. The task of keeping the law responsive to human needs is the work of lawyers. Also called attorneys, lawyers are the link between the legal system and society. To perform this role, they must understand the world around them and be sensitive to the numerous aspects of society that are touched by the law. They must comprehend not only the words of a particular statute, but the human circumstances it addresses as well.

As our body of laws grows more voluminous and complex, as the legal system takes on new regulatory tasks in social welfare, racial integration, energy conservation, and other areas, the work of lawyers takes on wider significance.

Nature of the Work

Lawyers perform a wide variety of tasks, but certain basic activities are common to nearly every attorney's work. Probably the most fundamental of all is interpretation of the law. Every attorney, whether representing the defendant in a murder trial or the plaintiff (suing party) in a lawsuit, combines an understanding of the relevant laws with knowledge of the facts in the particular case in order to determine how the first affects the second. Based on this determination, the attorney decides what courses of action would best serve the interests of the party he or she represents.

In order to interpret the law knowledgeably, lawyers do research. They must stay abreast of their field, in both legal and nonlegal matters. An attorney representing electronics manufacturers, for example, must follow trade journals as well as the latest Federal regulations affecting his or her clients. Attorneys in the State Department must remain well-versed in current events and international law, while divorce lawyers spend a certain portion of their time reading about the changing role of the family in modern society. Research also includes specific, in-depth reading on the legal questions or substantive matters of an individual case. In any event, the overwhelming volume of literature to be digested requires a lawyer to conduct research efficiently, quickly picking out and evaluating the substance of a particular article or court case.

Usually a lawyer's work also involves contact with people. Attorneys consult with their clients to determine the details of their specific

problems, advise them of the law, and suggest actions that might or must be taken. To be effective, a lawyer learns to deal with people in a courteous, efficient fashion.

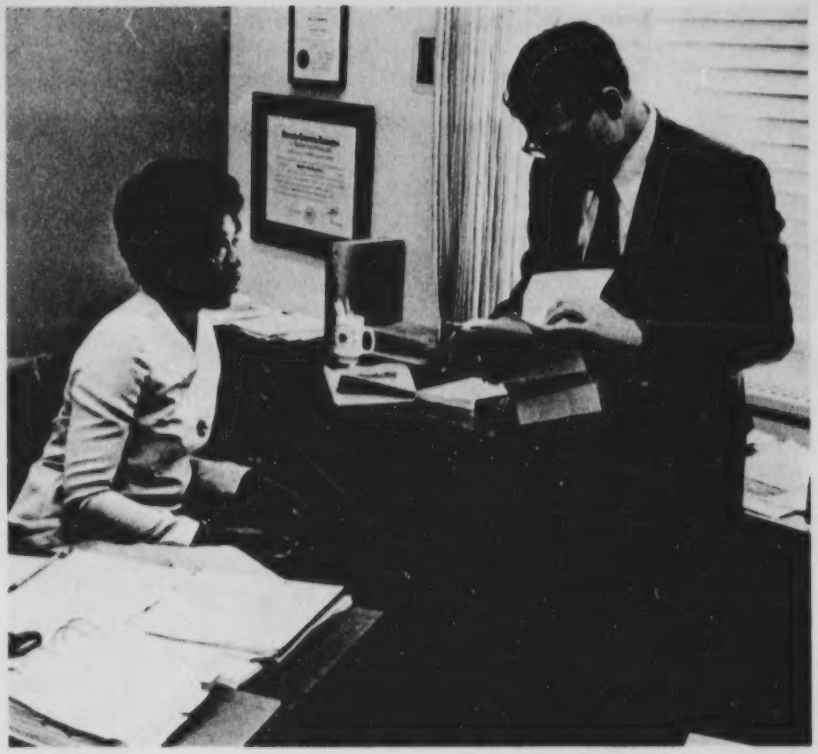
Finally, most lawyers must do some writing in the course of their work. This may take the form of reports, legal briefs, or administrative paperwork. In all cases, the attorney calls upon his or her ability to communicate clearly and precisely.

The more detailed aspects of the legal profession depend upon the lawyer's individual field and position. Most lawyers are engaged in general practice and handle all kinds of legal work for clients. They counsel the individual who wants to buy property, make a will, sign a contract, or settle an estate. These lawyers perform whatever tasks are necessary to help their client comply with the law.

A significant number specialize in one branch of law, such as corporate, criminal, labor, patent, real estate, tax, or international law. Communications lawyers, for example, may represent radio and television stations in their dealings with the Federal Communications Commission (FCC). They help established stations prepare and file license renewal applications, employment reports, and other documents required by the FCC on a regular basis. They also keep their clients informed of changes in FCC regulations. Communications lawyers give similar assistance to individuals or corporations wishing to buy or sell a station or establish a new one.

Other lawyers specialize in representing public utilities before the Federal Power Commission (FPC) and other regulatory agencies. For example, they handle matters involving the reasonableness of utility rates. They help a firm develop its case, assist in preparing strategy, arguments, and testimony, prepare the case for presentation at a trial or administrative hearing, and argue the case. These lawyers also keep clients informed about changes in regulations and advise them as to the legality of their actions.

Private practitioners specialize in other areas, too. Some draw up wills, trusts, contracts, mortgages, and other legal documents; conduct out-of-court negotiations; and do investigative and other legal work to prepare for trials. Some may act as trustees by managing a person's property and funds, or as executors by seeing that the provisions of their client's will are carried out. A small number of lawyers devote themselves entirely to courtroom work. An increasing number handle only so-called public interest cases. These cases, either civil or criminal, have a potential impact extending well beyond the individual client. Attorneys who take these cases hope to use them as a vehicle for legal and social reform.



Corporate lawyers reviewing legal matters pertaining to the company.

Some lawyers are employed full time by a single client. Known as house counsel, these lawyers usually work for a corporate firm, advising and acting on legal questions that arise from the company's business activities. These questions may involve patents for new productions, FTC regulations, a business contract with another company, or a collective bargaining agreement with a union.

Attorneys employed at the various levels of government constitute still another category. Criminal lawyers may work in the office of a State attorney general; they also may be employed by a prosecutor's or public defender's office, or by the court itself. At the Federal level, attorneys perform investigations for the Justice Department and regulatory agencies. Lawyers at every level of government also help develop laws and programs; they prepare drafts of proposed legislation, establish law enforcement procedures, and argue cases.

Many people who have legal training do not work as lawyers but use their knowledge of law in other occupations. They may, for example, be journalists, management consultants, financial analysts, insurance claim adjusters, tax collectors, probation officers, and credit investigators. A legal background also is an asset to those seeking or holding public office.

Places of Employment

About 396,000 persons worked as lawyers in 1976. Almost three-fourths of them, 280,000, practiced privately, with about 40 percent in

solo practice and the other 60 percent working in law firms. Of the remaining 116,000, about one-third were employed as house counsel by various business firms; one-fourth worked in the Federal Government; the remainder held positions in State and local government. In addition, about 8,000 lawyers taught full or part time in law schools. Some salaried lawyers also have independent practices; others do legal work part time while in another occupation.

Training, Other Qualifications, and Advancement

In order to practice law in the courts of any State, a person must be admitted to its bar. Applicants for admission to the bar must pass a written examination; however, a few States drop this requirement for graduates of their own law schools. Lawyers who have been admitted to the bar in one State occasionally may be admitted in another without taking an examination provided they meet that State's standards of good moral character and have a specified period of legal experience. Each Federal court or agency sets its own qualifications for those practicing before it.

To qualify for the bar examination in most States, an applicant must have completed 3 years of college and have graduated from a law school approved by the American Bar Association (ABA) or the proper State authorities. (ABA approval signifies that the law school meets the minimum standards necessary to allow its graduates to take the bar exam and practice law in any State. Graduates of nonapproved schools are restricted to the State in which the school is located.) A few States accept the study of law wholly in a law office or in combination with study in a law school; only California accepts the study of law by correspondence as qualification for taking the bar exam. Several States require registration and approval of students by the State Board of Examiners, either before they enter law school or during the early years of legal study. In a few States, candidates must complete clerkships before they are admitted to the bar.

Although there is no nationwide bar exam, most States and the District of Columbia participate in the Multistate Bar Examination (MBE). The MBE, covering issues of broad interest, is given in addition to the State bar exam; how the MBE score is treated varies from State to State.

The required college and law school education usually takes 7 years of full-time study after high school—4 years of undergraduate study followed by 3 years in law school. Although a number of law schools accept students after 3 years of college, an increasing number require applicants to have a bachelor's degree. To meet the needs of students who can attend only part time, a number of law schools have night or part-time divisions which usually require 4 years of study. In 1976, about one-fifth of all graduates of ABA-approved schools were part-time students.

Competition for admission to law school has become intense in the last few years. Enrollments rose very rapidly between 1969 and 1972, and, according to one estimate, applications outnumbered available openings by almost 10 to 1 in the mid-1970's. Although the increase in enrollments is expected to slow by the 1980's, law school admission will remain the first of several hurdles for prospective lawyers.

Preparation for a career as a lawyer really begins in college. Although there is no such thing as a "prelaw major," the undergraduate program almost always makes a difference. Certain courses and activities are desirable because they give the student the skills needed to succeed both in law school and in the profession. Essential skills—the ability to write, to read and analyse, to think conceptually and logically, and to communicate verbally—are learned during high school and college. The best undergraduate program is one that cultivates these skills while at the same time broadening the student's view of the world. Majors in the social sciences, natural sciences, and humanities all fill the bill, as long as the student does not specialize too narrowly.

Students interested in a particular aspect of the law may find it helpful to take related courses; for example, engineering and science courses for the prospective patent attorney, and accounting for the future tax lawyer. In addition, typing is advisable simply for convenience in law school.

Acceptance by most law schools depends on the applicant's ability to demonstrate an aptitude for the study of law, usually through good grades and the Law School Admission Test (LSAT), administered by the Educational Testing Service. In 1976, 163 law schools had American Bar Association approval. Others—chiefly night schools—were approved by State authorities only.

The first year or year and a half of law school generally is devoted to fundamental courses such as constitutional law, contracts, property law, and judicial procedure. In the remaining time, students may elect specialized courses in fields such as tax, labor, or corporation law. Practical experience often is acquired by participation in school-sponsored legal aid activities, in the school's practice court where students conduct trials under the supervision of experienced lawyers, and through writing on legal issues for the school's law journal. Graduates receive the degree of *juris doctor* (J.D.) from most schools as the first professional degree. Advanced study often is desirable for those planning to specialize, do research, or teach in law schools.

The practice of law involves a great deal of responsibility. Persons planning careers in law should like to work with people and ideas, and be able to win the confidence of their clients.

Most beginning lawyers start in salaried positions, although some go into independent practice immediately after passing the bar examination. Newly hired salaried attorneys usually act as research assistants (law clerks) to experienced lawyers or judges. After several years of progressively responsible salaried employment, many lawyers go into practice for themselves. Some lawyers, after years of practice, become judges.

Employment Outlook

A rapid increase in the number of law school graduates has created

keen competition for the available jobs. In the years ahead, the number of graduates is expected to increase further and intensify this competition.

Employers will be selective in hiring new lawyers. Graduates of well-known law schools and those who rank high in their classes should find salaried positions with law firms, on the legal staffs of corporations and government agencies, and as law clerks for judges. Graduates of less prominent schools and those with lower scholastic ratings will experience some difficulty in finding salaried jobs. However, many will find opportunities in fields where legal training is an asset but not normally a requirement.

The employment of lawyers is expected to grow faster than the average for other occupations through the mid-1980's as increased business activity and population create a demand for attorneys to deal with a growing number of legal questions. Supreme Court decisions extending the right to counsel for persons accused of lesser crimes, the growth of legal action in the areas of consumer protection, the environment, and safety, and an expected increase in the use of legal services by middle-income groups through prepaid legal service programs also should provide employment opportunities. Other jobs will be created by the need to replace lawyers who die, retire, or leave the occupation for other reasons.

Prospects for establishing a new practice probably will continue to be best in small towns and expanding suburban areas, as long as there already exists an active market for legal services in which the new lawyer can find clients. In such communities competition is likely to be less than in big cities and new lawyers may find it easier to become known to potential clients; also, rent and other business costs are somewhat lower. Nevertheless, starting a new practice will remain an expensive and risky proposition that should be weighed carefully. Salaried positions will be limited largely to urban areas where the chief employers of legal talent—government agencies, law firms, and big corporations—are concentrated.

Earnings and Working Conditions

Lawyers entering practice in 1976 earned a wide range of starting salaries—from about $10,000 to $23,000 a year. Most fell in the $15,000 to $18,000 range. Factors affecting the salaries offered to new graduates include: their academic records; type, size, and location of their employers; and whether the new lawyer has any specialized educational background that the employer requires. The field of law makes a difference, too. Patent lawyers, for example, tend to earn more than general corporate attorneys. Lawyers with at least a year's experience working in manufacturing and business firms earned about $18,000 a year; those with a few years of experience earned $30,000 or more annually. In the Federal Government, annual starting salaries for attorneys in 1977 were $14,097 or $17,056, depending upon academic and personal qualifications. Federal attorneys with some experience earned $24,308 or more a year.

Beginning lawyers engaged in legal-aid work usually receive the lowest starting salaries. New lawyers starting their own practices may earn little more than expenses during the first few years and may need to work part time in other occupations.

Lawyers on salary receive increases as they assume greater responsibility. Incomes of lawyers in private practice usually grow as their practices develop. Private practitioners who are partners in law firms generally earn more than those who practice alone.

Lawyers often work long hours and are under considerable pressure when a case is being tried. In addition, they must keep abreast of the latest laws and court decisions. However, since lawyers in private practice can determine their own hours and workload, many stay in practice well past the usual retirement age.

Sources of Additional Information

Persons considering law as a career will find information on law schools and prelaw study in the *Prelaw Handbook*, published annually (Princeton, N.J.: Educational Testing Service). Copies may be available in public or school libraries. In addition, many colleges and universities have a prelaw advisor who counsels undergraduates about their undergraduate course work, the LSAT, law school applications, and other matters.

Information on law schools and law as a career is available from:

Information Services, The American Bar Association, 1155 East 60th St., Chicago, Ill. 60637. (There may be a slight charge for publications.)

Information on law school accreditation is available from:

Association of American Law Schools, Suite 370, 1 Dupont Circle NW., Washington, D.C. 20036.

For advice on financial aid, contact a law school financial aid officer.

The specific requirements for admission to the bar in a particular State may be obtained at the State capital from the clerk of the Supreme Court or the secretary of the Board of Bar Examiners.

MARKETING RESEARCH WORKERS

(D.O.T. 050.088)

Nature of the Work

Businesses require a great deal of information to make sound decisions on how to market their products. Marketing research workers provide much of this information by analyzing available data on products and sales. If additional information is required but not available, they conduct marketing surveys, by interviewing those likely to have the needed data. They also prepare sales forecasts and make recommendations on product design and advertising.

Most marketing research starts with the collection of facts from sources such as company records, published materials, and experts on the subject under investigation. For example, marketing research workers making sales forecasts may begin by studying the growth of sales volume in several different cities. This growth may then be traced to increases in population, size of the

Market research workers often test reactions to a company's product.

company's sales force, or amount of money spent on advertising. Other marketing research workers may study changes in the quantity of company goods on store shelves or make door-to-door surveys to get information on company products.

Marketing research workers often are concerned with customers' opinions and tastes. For example, to help decide on the design and price of a new line of television sets, marketing research workers may survey consumers to find out what styles and price ranges are most popular. This type of survey usually is supervised by marketing researchers who specialize in consumer goods; that is, merchandise sold to the general public. They may be helped by statisticians who select a group (or sample) to be interviewed and "motivational research" specialists who phrase questions to produce reliable information. Once the investigation is underway, the marketing researcher may supervise the interviewers as well as direct the office workers who tabulate and analyze the information collected.

Marketing surveys on products used by business and industrial firms may be conducted differently from surveys for consumer goods. Marketing researchers often conduct the interviews themselves to gather opinions of the product. They also may speak to company officials about new uses for it. They must therefore have specialized knowledge of both marketing techniques and the industrial uses of the product.

Places of Employment

About 25,000 full-time marketing research workers were employed in 1976. Most jobs for marketing research workers are found in manufacturing companies, advertising agencies, and independent research organizations. Large numbers are employed by stores, radio and television firms, and newspapers; others work for university research centers and government agencies. Marketing research organizations range in size from one-person enterprises to firms with a hundred employees or more.

New York City has a large number of marketing research workers. Many major advertising agencies, independent marketing organizations, and central offices of large manufacturers are located there. Another large concentration is in Chicago. However, marketing research workers are employed in many other cities as well—wherever there are central offices of large manufacturing and sales organizations.

Training, Other Qualifications, and Advancement

Although a bachelor's degree usually is sufficient for trainees, graduate education is necessary for many specialized positions in marketing research. Graduate study usually is required for advancement, and a sizable number of market researchers have a master's degree in business administration or other graduate degree as well as a bachelor's degree in marketing. Some people qualify for jobs through previous experience in other types of research; university teachers of marketing or statistics, for example, may be hired to head marketing research departments in business firms or advertising agencies.

Bachelor's programs in marketing and related fields, including courses in statistics, English composition, speech, psychology, and economics, are valuable preparation for work in marketing research. Some marketing research positions require specialized skills such as engineering, or substantial sales experience and a thorough knowledge of the company's products. Knowledge of data processing is helpful because of the increasing use of computers in sales forecasting, distribution, and cost analysis.

College graduates may find their first job in any of a number of places: in the market research department of a large company, with a research firm, in a government planning agency, or even in a university marketing department.

Trainees usually start as research assistants or junior analysts. At first, they may do considerable clerical work, such as copying data from published sources, editing and coding questionnaires, and tabulating survey returns. They also learn to conduct interviews and write reports on survey findings. As they gain experience, assistants and junior analysts may assume responsibility for specific marketing research projects, or advance to supervisory positions. An exceptionally able worker may become marketing research director or vice president for marketing and sales.

Either alone or as part of a team, marketing research workers must be able to analyze problems objectively and apply various techniques to their solution. As advisers to management, they should be able to write clear reports informing company officials of their findings.

Employment Outlook

Opportunities should be best for applicants with graduate training in marketing research or statistics. The growing complexity of marketing research techniques also may expand opportunities in this field for psychologists, economists, and other social scientists.

Marketing research employment rises as new products and services are developed, particularly when business activity and personal incomes are expanding rapidly. In periods of slow economic growth, however, the reduced demand for marketing services may limit the hiring of research workers.

Over the long run, population growth and the increased variety of goods and services that businesses and individuals will require are expected to stimulate a high level of marketing activity. As a result, employment of marketing research workers is expected to grow much faster than the average for other occupations through the mid-1980's.

Competition among manufacturers of both consumer and industrial products will make the appraising of marketing situations increasingly important. As techniques improve and statistical data accumulate, company officials are likely to turn more often to marketing research workers for information and advice.

Earnings and Working Conditions

Salaries for marketing research trainees were about $11,000 a year in 1976, according to the limited information available. Persons with master's degrees in business administration and related fields usually started with salaries around $15,000 a year. Starting salaries varied according to the type, size, and location of the firm as well as the exact nature of the position. Generally, though, starting salaries were somewhat higher and promotion somewhat slower than in other occupations requiring similar training.

Experienced workers such as senior analysts received salaries over $19,000 a year. Earnings were highest, however, for workers in management positions of great responsibility. Directors of marketing research earned well over $25,000 a year in 1976.

Marketing research workers usually work in modern, centrally located offices. Some, especially those employed by independent research firms, may travel for their work. Also, they may frequently work under pressure and for long hours to meet deadlines.

Sources of Additional Information

A pamphlet, "Careers in Marketing" (Monograph Series No. 4), may be purchased for $1.50 from:

American Marketing Association, 222 South Riverside Plaza, Chicago, Ill. 60606.

PERSONNEL AND LABOR RELATIONS WORKERS

(D.O.T. 166.088 through .268; 169.118)

Nature of the Work

Attracting the best employees available and matching them to the jobs they can do best is important for the success of any organization. Today, most businesses are much too large for close contact between owners and their employees. Instead, personnel and labor relations workers provide the link between management and employees—assisting management to make effective use of employees' skills, and helping employees to find satisfaction in their jobs and working conditions. Although some jobs in this field require only limited contact with people outside the office, most involve frequent contact with other people. Dealing with people is an essential part of the job.

Personnel workers and labor relations workers concentrate on different aspects of employer-employee relations. Personnel workers interview, select, and recommend applicants to fill job openings. They handle wage and salary administration, training and career development, and employee benefits. "Labor relations" usually means union-management relations, and people who specialize in this field work for the most part in unionized business firms and government agencies. They help officials prepare for collective bargaining sessions, participate in contract negotiations with the union, and handle labor relations matters that come up every day.

In a small company, personnel work consists mostly of interviewing and hiring, and one person usually can handle it all. By contrast, a large organization needs an entire staff, which might include recruiters, interviewers, counselors, job analysts, wage and salary analysts, education and training specialists, and labor relations specialists, as well as technical and clerical workers.

Personnel work often begins with the *personnel recruiter* or *employment interviewer* (D.O.T. 166.268), who works on a person-to-person basis with present and prospective employees. Recruiters travel around the country, often to college campuses, in the search for promising job applicants. Interviewers talk to applicants, and select and recommend those who appear qualified to fill vacancies. They often administer tests to applicants and interpret the results. Hiring and placement specialists need to be thoroughly familiar with the organization and its personnel policies, for they must be prepared to discuss wages, working conditions, and promotional opportunities with prospective and newly hired employees. They also need to keep informed about equal employment opportunity and affirmative action guidelines. Equal employment opportunity is a complex and sensitive area of personnel work which in some large organizations is handled by special EEO counselors or coordinators. The work of employment counselors, which is similar in a number of ways, is described in a separate statement elsewhere in the *Handbook*.

Job analysts (D.O.T. 166.068) and *salary and wage administrators* (D.O.T. 169.118) do very exacting work. Job analysts collect and analyze detailed information on jobs, job qualifications, and worker characteristics in order to prepare job descriptions, sometimes called position classifications, that tell exactly what the duties of a job are and what training and skills it requires. Whenever a government agency or large business firm introduces a new job or evaluates existing ones, it calls upon the expert knowledge of the job analyst. Accurate information about job duties also is required when a firm evaluates its pay system and considers changes in wages and salaries. Establishing and maintaining pay systems is the principal job of wage administrators. They devise ways of making sure that pay rates within the firm are fair and equitable, and conduct surveys to see how their pay rates compare with those elsewhere. Being sure that the firm's pay system complies with laws and regulations is another part of the job, one that requires knowledge of compensation structures and labor law.

Training specialists supervise or conduct training sessions, prepare manuals and other materials for these courses, and look into new methods of training. They also counsel employees on training opportunities, which may include on-the-job, apprentice, supervisory, or management training.

Employee-benefits supervisors and other personnel specialists handle the employer's benefits program, which often includes health insurance, life insurance, disability insurance, and pension plans. These workers also coordinate a wide range of employee services, including cafeterias and snack bars, health rooms, recreational facilities, newsletters and communications, and counseling for work-related personal problems. Counseling employees who are approaching retirement age is a particularly important part of the job of these workers.

Occupational safety and health programs are handled in various ways. Quite often, in small companies especially, accident prevention and industrial safety are the responsibility of the personnel department—or of the labor relations specialist, if the union has a safety representative. Increasingly, however, there is a separate safety department under the direction of a safety and health professional, generally a safety engineer or industrial hygienist. (The work of occupational safety and health workers is discussed elsewhere in the *Handbook*.)

Labor relations specialists (D.O.T. 169.118) advise management on all aspects of union-management relations. When the contract is up for negotiation, they provide background information and technical support, a job that requires extensive knowledge of economics, labor law, and collective bargaining trends. Actual negotiation of the agreement is conducted at the top level, with the director of labor relations or other top-ranking official serving as the employer's representative, but members of the company's labor relations staff play an important role throughout the negotiations.

Much of the everyday work of the labor relations staff concerns interpretation and administration of the contract, the grievance procedures in particular. Members of the labor relations staff might work with the union on seniority rights under the layoff procedure set forth in the contract, for example. Later in the day, they might meet with the union steward about a worker's grievance. Doing the job well means staying abreast of current developments in labor law, including arbitration decisions, and maintaining continuing liaison with union officials.

Personnel workers in government agencies generally do the same kind of work as those in large business firms. There are some differences, however. Public personnel workers deal with employees whose jobs are governed by civil service regulations. Civil service jobs are strictly classified as to duties, training, and pay. This requires a great deal of emphasis on job analysis and wage and salary classification; many people in public personnel work spend their time classifying and evaluating jobs, or devising, administering, and scoring competitive examinations given to job applicants.

Knowledge of rules and regulations pertaining to affirmative action and equal opportunity programs is important in public personnel work. In 1972, the U.S. Civil Service Commission established a specialization for Federal personnel workers concerned with promoting equal opportunity in hiring, training, and advancement. Similar attention to equal employment opportunity, accompanied by a need for qualified staff, is evident in State and local government agencies.

Labor relations is an increasingly important specialty in public personnel administration. Labor relations in this field have changed considerably in recent years, as union strength among government workers has grown. This has created a need for more and better trained workers to handle negotiations, grievances, and arbitration cases on behalf of Federal, State, and local government agencies.

Places of Employment

In 1976, about 335,000 people were personnel and labor relations workers. Nearly 3 out of 4 worked in private industry, for manufacturers, banks, insurance companies, airlines, department stores, and other business concerns. Some worked for private employment agencies, including executive job-search agencies, "office temporaries" agencies, and others.

A large number of personnel and labor relations workers, over 90,000 in 1976, worked for Federal, State, and local government agencies. Most of these were in personnel administration; they handled recruitment, interviewing, testing, job classification, training, and other personnel matters for the Nation's 15 million public employees. Some were on the staff of the U.S. Employment Service and State employment agencies. Still others worked for agencies that oversee compliance with labor laws. Some, for example, were wage-hour compliance officers; their work is described in another part of the *Handbook*, in the statement on health and regulatory inspectors (Government). Other public employees in this field carried out research in economics, labor law, personnel practices, and related sub-

jects, and sought new ways of ensuring that workers' rights under the law are understood and protected.

In comparison with private industry, labor unions do not employ a large number of professionally trained labor relations workers. An elected union official generally handles labor relations matters at the company level. At national and international union headquarters, however, the research and education staff usually includes specialists with a degree in industrial and labor relations, economics, or law.

A few personnel and labor relations workers are in business for themselves as management consultants or labor-management relations experts. In addition, some people in the field teach college or university courses in personnel administration, industrial relations, and related subjects.

Most jobs for personnel and labor relations workers are located in the highly industrialized sections of the country.

Training, Other Qualifications, and Advancement

Many employers seek to fill beginning positions in personnel and labor relations with college graduates. Some employers look for graduates who have majored in personnel administration or industrial and labor relations, while others prefer college graduates with a general business background. Still other employers feel that a well-rounded liberal arts education is the best preparation for personnel work. A college major in personnel administration, political science, or public administration can be an asset in looking for a job with a government agency.

At least 200 colleges and universities have programs leading to a degree in the field of personnel and labor relations. (While personnel administration is widely taught, the number of programs that focus primarily on labor relations is quite small.) In addition, many schools offer course work in closely related fields. An interdisciplinary background is appropriate for work in this area, and a combination of courses in the social sciences, behavioral sciences, business, and economics is useful.

Prospective personnel workers might include courses in personnel management, business administration, public administration, psychology, sociology, political science, economics, and statistics. Courses in labor law, collective bargaining, labor economics, labor history, and industrial psychology provide valuable backgound for the prospective labor relations worker.

Graduate study in industrial or labor relations is often required for work in labor relations. While a law degree seldom is required for jobs at the entry level, most of the people with responsibility for contract negotiations are lawyers, and a combination of industrial relations courses and a law degree is becoming highly desirable.

A college education is important, but it is not the only way to enter personnel work. Some people enter the field at the clerical level, and advance to professional positions on the basis of experience. They often find it helpful to take college courses part time, however.

New personnel workers usually enter formal or on-the-job training programs to learn how to classify jobs, interview applicants, or administer employee benefits. After the training period, new workers are assigned to specific areas in the company's employee relations department. After gaining experience, they usually can advance within their own company or transfer to another employer. At this point, some people move from personnel to labor relations work.

A growing number of people enter the labor relations field directly, as trainees. They usually are graduates of master's degree programs in industrial relations, or may have a law degree. Quite a few people, however, begin in personnel work, gain experience in that area, and subsequently move into a labor relations job.

Workers in the middle ranks of a large organization often transfer to a top job in a smaller one. Employees with exceptional ability may be promoted to executive positions, such as director of personnel or director of labor relations.

Personnel and labor relations workers should speak and write effectively and be able to work with people of all levels of education and experience. They also must be able to see both the employee's and the employer's points of view. In addition, they should be able to work as part of a team. They need supervisory abilities and must be able to accept responsibility. Integrity and fairmindedness are important qualities for people in personnel and labor relations work. A persuasive, congenial personality can be a great asset.

Employment Outlook

The number of personnel and labor relations workers is expected to grow faster than the average for all occupations through 1985, as employers, increasingly aware of the benefits to be derived from good labor-management relations, continue to support sound, capably staffed employee relations programs. In addition to new jobs created by growth of the occupation, many openings will become available each year because of the need to replace workers who die, retire, or leave their jobs for other reasons.

Legislation setting standards for employment practices in the areas of occupational safety and health, equal employment opportunity, and pensions has stimulated demand for personnel and labor relations workers. Continued growth is foreseen, as employers throughout the country review existing programs in each of these areas and, in many cases, establish entirely new ones. This has created job opportunities for people with appropriate expertise. The effort to end discriminatory employment practices, for example, has led to scrutiny of the testing, selection, placement, and promotion procedures in many companies and government agencies. The findings are causing a number of employers to modify these procedures, and to take steps to raise the level of professionalism in their personnel departments.

Substantial employment growth is foreseen in the area of public personnel administration. Opportunities probably will be best in State and local government, areas that are ex-

pected to experience strong employment growth over the next decade. By contrast, Federal employment will grow slowly. Moreover, as union strength among public employees continues to grow, State and local agencies will need many more workers qualified to deal with labor relations. Enactment of collective bargaining legislation for State and local government employees could greatly stimulate demand for labor relations workers knowledgeable about public sector negotiations.

Although the number of jobs in both personnel and labor relations is projected to increase over the next decade, competition for these jobs also is increasing. Particularly keen competition is anticipated for jobs in labor relations. A small field, labor relations traditionally has been difficult to break into, and opportunities are best for applicants with a master's degree or a strong undergraduate major in industrial relations, economics, or business. A law degree is an asset.

Earnings and Working Conditions

Beginning job analysts in private industry started at $11,200 a year in 1976, according to a Bureau of Labor Statistics survey. Experienced job analysts earned $19,200 a year, about twice the average for all nonsupervisory workers in private industry, except farming. Wage and salary administrators earned about $19,800 and personnel managers averaged $21,100, according to a survey conducted by the Administrative Management Society. Top personnel and labor relations executives in large corporations earned considerably more.

Average salaries for personnel specialists employed by State governments ranged from $9,900 to $13,000 a year in 1976, according to a survey conducted by the U.S. Civil Service Commission. Personnel specialists who had supervisory responsibilities averaged from $14,800 to $19,500 and State directors of personnel earned average salaries ranging from $27,400 to $31,900 a year.

In the Federal Government, new graduates with a bachelor's degree generally started at $9,300 a year in 1977. Those with a master's degree started at about $14,100 a year. Average salaries of Federal employees in several different areas of personnel work ranged from about $19,300 to $24,500 in 1977, as follows:

Staffing specialists	$19,300
Position classifiers	21,100
Personnel management specialists	21,800
Employee development specialists	21,800
Salary and wage administrators	21.800
Occupational analysts	24,500
Mediators	30,800

Federal employees in the field of labor relations had generally comparable salaries. Labor-management and employee relations specialists and labor-management relations officers averaged $21,800 a year in 1977. Federal mediators' salaries were higher, about $30,800 a year, on the average.

Employees in personnel offices generally work 35 to 40 hours a week. As a rule, they are paid for holidays and vacations, and share in retirement plans, life and health insurance plans, and other benefits available to all professional workers in their organizations.

Sources of Additional Information

For general information on careers in personnel and labor relations work, write to:

American Society for Personnel Administration, 19 Church St., Berea, Ohio 44017.

For information concerning a career in employee training and development, contact:

American Society for Training and Development, P.O. Box 5307, Madison, Wis. 53705.

Information about careers in public personnel administration is available from:

International Personnel Management Association, 1313 E. 60th St., Chicago, Ill. 60637.

A brochure describing a career in labor-management relations as a field examiner is available from:

Director of Personnel, National Labor Relations Board, 1717 Pennsylvania Ave. NW., Washington, D.C., 20570.

PUBLIC RELATIONS WORKERS

(D.O.T 165.068)

Nature of the Work

Public relations workers apply their talent for communication in many different areas. They may handle press, community, or consumer relations, sales promotion, political campaigning, interest-group representation, fund raising, or employee recruitment. The role they play is crucial to improved understanding and cooperation among the diverse individuals, groups, organizations, and institutions that make up our society.

How successfully an organization presents goals and policies may affect its public acceptance, prosperity, and even its continued existence. Public relations workers help organizations build and maintain positive public reputations. Public relations is more than telling the employer's "story," however. Understanding the attitudes and concerns of customers, employees, and various other "publics"—and communicating this information to management—is an important part of the job.

Public relations departments are found in organizations of all kinds, and workers must tailor their programs to an employer's particular needs. A public relations director for a college or university, for example, may devote most of his or her energies to attracting additional students, while one in a large corporation may handle the employer's relations with stockholders, government agencies, and community groups.

Public relations workers put together information that keeps the public aware of their employer's activities and accomplishments and keeps management aware of public attitudes. After preparing the information, they may contact people in the media who might be interested in publicizing their material. Many radio or television public service announcements or special reports, newspaper items, and magazine arti-

Public relations workers help organizations build and maintain a positive public image.

cles start at public relations workers' desks. Sometimes the subject is a company and its policies towards its employees or its role in the community. Often the subject is a public issue, such as health, nutrition, energy, or the environment.

Public relations workers also arrange and conduct programs in which company representatives will have direct contact with the public. Such work includes setting up speaking engagements for company officials and writing speeches for them. These workers often serve as an employer's representative during community projects or occasionally may show films at school assemblies, plan conventions, or manage fund-raising campaigns.

Public relations staffs in very large firms may number 200 or more, but in most firms the staff is much smaller. The director of public relations, who is often a vice president, may develop overall plans and policies with a top management executive. In addition, large public relations departments employ writers, research workers, and other specialists who prepare material for the different media, stockholders, and other publics.

Workers who handle publicity for an individual or direct public relations for a university or small business may handle all aspects of the job. They make contacts with people outside the organization, do the necessary planning and research, and prepare material for publication. These workers may combine public relations duties with advertising or sales promotion work; some are top-level officials and others have lower level positions. The most skilled public relations work of making overall plans and maintaining contacts usually is done by the department director and highly experienced staff members.

Places of Employment

About 115,000 persons were public relations workers in 1976. Manufacturing firms, public utilities and transportation companies, insurance companies, and trade and professional associations employ many public relations workers. A sizable number work for government agencies (the Federal Government alone employs several thousand public information specialists), or for schools, colleges, museums, and other educational, religious, and human service organizations. The rapidly expanding health field also offers opportunities for public relations work, in hospitals, pharmaceutical companies, and medical associations, for example. A number of public relations workers are employed by public relations consulting firms which furnish public relations services to clients for a fee. Some work for advertising agencies.

Public relations workers are concentrated in large cities where press services and other communications facilities are readily available, and where many businesses and trade associations have their headquarters. More than half of the estimated 2,000 public relations consulting firms in the United States are in New York, Los Angeles, Chicago, and Washington, D.C. A major trend, however, is the dispersal of public relations jobs throughout the Nation, including smaller towns.

Training, Other Qualifications, and Advancement

A college education combined with public relations experience is an excellent preparation for public relations work. Although most beginners have a college degree in journalism, communications, or public relations, some employers prefer a background in a field related to the firm's business—science, finance, or engineering, for example. Some firms want college graduates with experience working for the news media. In fact, many editors, reporters, and workers in closely related fields enter public relations work.

In 1976, about 90 colleges and more than 30 graduate schools offered degree programs or special curriculums in public relations, usually administered by the journalism or communications department. In addition, about 200 colleges offered at least one course in this field. Courses include public relations theory and

techniques, organizational communication, public relations management and administration, practical courses in public relations, and others. Specialties are offered in public relations in business, government, and nonprofit organizations. Persons with a bachelor's degree in public relations or a related field generally enter staff positions whereas those with a graduate degree are more qualified for administrative and managerial jobs.

Public relations workers must have considerable ability to gather information, write, speak, and deal effectively with people. Courses in journalism, business administration, psychology, sociology, political science, advertising, English, and public speaking help in preparing for a public relations career. Extracurricular activities such as writing for a school publication or television or radio station provide valuable experience. Many schools help students gain part-time or summer internships in public relations which provide training that can help in competing for entry positions. Membership in the Public Relations Student Society of America provides an opportunity for students to exchange views with public relations practitioners and to make professional contacts that may be helpful in later securing a job in the field. A portfolio of published articles, television or radio programs, slide presentations, and other work samples usually is an asset in finding a job.

Creativity, initiative, and the ability to express thoughts clearly and simply are important to the public relations worker. Fresh ideas are so vital in public relations that some experts spend all their time developing new ideas, leaving the job of carrying out programs to others.

People who choose public relations as a career need an outgoing personality, self-confidence, and an understanding of human psychology. They should have the enthusiasm necessary to motivate people. Public relations workers need a highly developed sense of competitiveness and the ability to function as part of a team.

Public information specialist positions in the Federal Government generally require a college degree. Media, writing, or editing experience may be quite helpful in gaining such a position. Requirements for similar positions in State and local governments vary.

Some companies—particularly those with large public relations staffs—have formal training programs for new workers. In other firms, new employees learn by working under the guidance of experienced staff members. Beginners often maintain files of material about company activities, scan newspapers and magazines for appropriate articles to clip, and assemble information for speeches and pamphlets. After gaining experience, they work on more difficult assignments, such as writing press releases, speeches, and articles for publication. In some firms, workers get all-round experience whereas in other firms, public relations workers tend to specialize.

Promotion to supervisory jobs may come as workers show they can handle more demanding and creative assignments. Some experienced public relations workers start their own consulting firms.

The Public Relations Society of America accredits public relations workers who have at least 5 years' experience in the field and have passed a comprehensive 6-hour examination (4 hours written, 2 hours oral). However, because of disagreements over the appropriateness of formal licensing requirements in this field, such requirements are not expected in the immediate future.

Employment Outlook

Employment of public relations workers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to new jobs created by this growth, openings will occur every year because of the need to replace workers who die, retire, or leave the field for other reasons.

Demand for public relations workers may be affected by economic conditions, slackening as employers delay expansion or impose staff cuts during business slowdowns. Over the long run, however, expenditures on public relations are expected to increase substantially. Corporations, associations, and other large organizations are likely to expand their public relations efforts to gain public support and approval.

Competition for beginning jobs is keen, for public relations work has an aura of glamour and excitement that attracts large numbers of jobseekers. Furthermore, the number of people who transfer into public relations from newspaper, advertising, or other closely related jobs is expected to exceed the number transferring out. This factor should serve to stiffen competition.

Prospects for a career in public relations are best for highly qualified applicants—talented people with sound academic preparation and some media experience. Most openings are expected to occur in large organizations—corporations, public relations consulting firms, manufacturing firms, educational institutions, and others.

Earnings and Working Conditions

Starting salaries for college graduates beginning in public relations work generally ranged from $7,500 to $10,000 a year in 1976; persons with a graduate degree generally started at a higher salary.

The salaries of experienced workers generally are highest in large organizations with extensive public relations programs. According to a 1976 survey, median annual salaries of public relations workers were as follows: Presidents of public relations consulting firms, $38,000; public information or relations directors and managers in the Federal Government, $23,500; in State government, $17,000; in local government, $22,000; in educational organizations, $23,500. According to a 1975 survey of a wide range of firms, public relations executives averaged $29,000-49,000 a year, while public relations managers averaged $21,000-31,000 a year, depending on the annual sales volume of the firm. Many firms offered incentive compensation. Based on a 1975 survey of advertising agencies, publi relations directors averaged $20,100 a year, while public relations account executives averaged $15,100.

Public relations consulting firms often pay higher salaries than organi-

zations with their own public relations departments. Salaries in manufacturing firms are among the highest while salaries in social welfare agencies, nonprofit organizations, hospitals, and universities are among the lowest.

In the Federal Government, bachelor's degree holders generally started at $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record; master's degree holders generally started at $14,097 a year; additional education or experience could qualify applicants for a higher salary. Public information specialists averaged about $24,300 a year in 1977.

Although the workweek for public relations staffs usually is 35 to 40 hours, overtime often is necessary to prepare or deliver speeches, attend meetings and community activities, or travel out of town. Occasionally, the nature of their regular assignments or special events requires public relations workers to be on call around the clock.

Sources of Additional Information

For career information and a list of schools offering degrees and courses in the field, write to:

Career Information, Public Relations Society of America, Inc., 845 Third Ave., New York, N.Y. 10022.

Current information on the public relations field, salaries, and other items is available from:

PR Reporter, Dudley House, P.O. Box 600, Exeter, N.H. 03833.

For additional information on job opportunities and the public relations field in general, write to:

Service Department, *Public Relations News*, 127 East 80th St., New York, N.Y. 10021.

PURCHASING AGENTS

(D.O.T. 162.158)

Nature of the Work

If materials, supplies, or equipment are not on hand when needed, an organization's work may be interrupted or halted. Maintaining an adequate supply of items an organization needs to operate is the purchasing agent's job.

Purchasing agents, also called industrial buyers, obtain goods and services of the required quality at the lowest possible cost, and see that adequate supplies are available. Agents who work for manufacturing firms buy machinery, raw materials, product components, and services; those working for government agencies may purchase office supplies, furniture, and business machines. Information on retail buyers, who purchase merchandise for resale in its original form, is presented in the statement on buyers elsewhere in the *Handbook*.

Purchasing agents buy when stocks on hand reach a predetermined reorder point, or when a department in the organization requisitions items it needs. Because agents often can purchase from many sources, their main job is selecting the seller who offers the best value.

Purchasing agents use a variety of means to select among suppliers. They compare listings in catalogs and trade journals and telephone suppliers to get information. They also meet with salespersons to examine samples, watch demonstrations of equipment, and discuss items to be purchased. Frequently agents invite suppliers to bid on large orders; then they select the lowest bidder among those who meet requirements for quality of goods and delivery date.

In some cases, however, purchasing agents must deal directly with a manufacturer to obtain specially designed items made exclusively for their organization. These agents must have a high degree of technical expertise to insure that all product specifications are met.

It is important that purchasing agents develop good business relations with their suppliers. This can result in savings on purchases, favorable terms of payment, and quick delivery on rush orders or materials in short supply. They also work closely with personnel in various departments of their own organization. For example, they may discuss product design with company engineers or shipment problems with workers in the traffic department.

Once an order has been placed with a supplier, the purchasing agent makes periodic checks to insure that it will be delivered on time. This is necessary to prevent work flow interruptions due to lack of materials. After an order has been received and inspected, the purchasing agent authorizes payment to the shipper.

Purchasing agents must develop good business relations with their suppliers.

Because of its importance, purchasing usually is designated as a separate responsibility within an organization. In a large firm or government agency, purchasing agents usually specialize in one or more specific items—for example, steel, lumber, cotton, or petroleum products. The agents are divided into sections, headed by assistant purchasing managers, that are responsible for a group of related commodities. In smaller organizations, agents generally are assigned certain categories of goods, such as all raw materials or all office supplies, furniture, and business machines.

Places of Employment

About 190,000 persons worked as purchasing agents in 1976. Over half worked in manufacturing industries. Large numbers also were employed by government agencies, construction companies, hospitals, and schools.

About half of all purchasing agents work in organizations that have fewer than five employees in the purchasing department. Many large business firms and government agencies, however, have much larger purchasing departments; some employ as many as 100 specialized buyers or more.

Training, Other Qualifications, and Advancement

Although there are no universal educational requirements for entry level jobs, most large companies now require a college degree, and prefer applicants with a master's degree in business administration. Training requirements vary with the needs of the firm. For example, companies that manufacture complex machinery or chemicals may prefer applicants with a background in engineering or science, while other companies hire business administration or liberal arts majors for trainee jobs. Courses in purchasing, accounting, econom cs, and statistics are very helpful. Familiarity with the computer and its uses also is desirable.

Small companies generally have less rigid educational requirements because they often purchase less complex goods in much smaller quantities. Some require a bachelor's degree; many others, however, hire graduates of associate degree programs in purchasing for entry level jobs. Promotion of clerical workers or technicians into purchasing jobs is much more common in small firms. Regardless of size of company, a college degree is becoming increasingly important for advancement to management positions.

The purchasing agent must be able to analyze numbers and technical data in order to make buying decisions and take responsibility for spending large amounts of money. The job requires the ability to work independently and a good memory for details. In addition, a purchasing agent must be tactful in dealing with salespersons and able to motivate others.

Regardless of their educational background, beginning purchasing agents initially spend considerable time learning about company operations and purchasing procedures. They may be assigned to the storekeeper's section to learn about the purchasing system, inventory records, and storage facilities. Next they may work with experienced buyers to learn about types of goods purchased, prices, and suppliers.

Following the initial training period, junior purchasing agents are given the responsibility for purchasing standard and catalog items. As they gain experience and develop expertise in their assigned areas, they may be promoted to purchasing agent, then senior purchasing agent. Workers with proven ability can move into a job as assistant purchasing manager in charge of a group of purchasing agents and then advance to manager of the entire purchasing department. Many purchasing managers move into executive positions as director of purchasing or director of materials management.

Continuing education is essential for purchasing agents who want to advance in their careers. Purchasing agents are encouraged to participate in frequent seminars offered by professional societies and to take courses in purchasing at local colleges and universities. The recognized mark of experience and professional competence in private industry is the designation Certified Purchasing Manager (CPM). This designation is conferred by the National Association of Purchasing Management, Inc., upon candidates who have passed four examinations and who meet educational and experience requirements. In government agencies, the indication of professional competence is the designation Certified Public Purchasing Officer (CPPO), which is conferred by the National Institute of Governmental Purchasing, Inc. The CPPO is earned by passing two examinations and meeting educational and experience requirements.

Employment Outlook

Employment of purchasing agents is expected to increase faster than the average for all occupations through the mid-1980's. Several thousand jobs will be open every year due to growth of the occupation and the need to replace those who die, retire, or transfer to other work.

Opportunities will be excellent for persons with a master's degree in business administration. Persons with a bachelor's degree in engineering, science, or business administration whose college program included one course or more in purchasing also should have bright prospects. Graduates of 2-year programs in purchasing should continue to find ample opportunities, although they will probably be limited to small firms.

Demand for purchasing agents is expected to rise as their importance in reducing costs is increasingly recognized. In large industrial organizations, the purchasing department will be expanded in order to handle the growing complexity of manufacturing processes. In companies that manufacture complex items such as industrial engines and turbines, electronic computer equipment, and communications equipment, there will be a growing need for persons with a technical background to select highly technical goods.

Many opportunities also should occur in firms providing personal, business, and professional services. Strong growth is expected for this sector of the economy, and a growing number of hospitals, school districts, and other relatively small employers

are recognizing the importance of professional purchasers in reducing their operating costs.

Earnings and Working Conditions

College graduates hired as junior purchasing agents in large firms earned about $11,700 a year in 1976, according to surveys conducted by the Bureau of Labor Statistics and Purchasing Magazine. Experienced agents purchasing standard items averaged about $14,200 a year; senior purchasing agents specializing in complex or technical goods averaged about $17,000. Assistant purchasing managers received average salaries of about $20,000 a year, while managers of a purchasing department received about $24,700. Many corporate directors of purchasing or materials management earned well over $50,000 a year. Salaries generally are higher in large firms where responsibilities often are greater. In 1976, earnings of purchasing agents were about 1 1/2 times as much as the average for all nonsupervisory workers in private industry, except farming.

In the Federal Government, beginning purchasing agents who had college degrees earned $9,300 or $11,500 in 1977, depending on scholastic achievement and relevant work experience. The average salary for all purchasing agents in the Federal Service was $20,500. Salary levels vary widely among State governments; however, average earnings range from $10,600 to $13,900 for purchasers of standard items, $14,200 to $18,800 for senior buyers purchasing highly complex items, and $21,000 to $26,000 for State purchasing directors.

Sources of Additional Information

Further information about a career in purchasing is available from:

National Association of Purchasing Management, Inc., 11 Park Place, New York, N.Y. 10007.

National Institute of Governmental Purchasing, Inc., 1001 Connecticut Ave. NW., Washington, D.C. 20036.

URBAN PLANNERS

(D.O.T. 199.168)

Nature of the Work

Urban planners, often called community or regional planners, develop programs to provide for future growth and revitalization of urban, suburban, and rural communities. They help local officials make decisions to solve social, economic, and environmental problems.

Planners examine community facilities such as health clinics and schools to be sure these facilities can meet the demands placed upon them. They also keep abreast of the legal issues involved in community development or redevelopment and changes in housing and building codes. Because suburban growth has increased the need for better ways of traveling to the urban center, the planner's job often includes designing new transportation and parking facilities.

Urban planners prepare for situations or needs that are likely to develop as a result of population growth or social and economic change. They estimate, for example, the community's long-range needs for housing, transportation, and business and industrial sites. Working within a framework set by the community government, they analyze and propose alternative ways to achieve more efficient and attractive urban areas.

Urban planners view the present and future development of the east coast.

Before preparing plans for long-range community development, urban planners prepare detailed studies that show the current use of land for residential, business, and community purposes. These reports present information such as the arrangement of streets, highways, and water and sewer lines, and the location of schools, libraries, and playgrounds. They also provide information on the types of industries in the community, characteristics of the population, and employment and economic trends. With this information, urban planners propose ways of using undeveloped land and design the layout of recommended buildings and other facilities such as subways. They also prepare materials that show how their programs can be carried out and the approximate costs.

Urban planners often confer with private land developers, civic leaders, and officials of public agencies that do specialized planning. They may prepare materials for community relations programs, speak at civic meetings, and appear before legislative committees to explain and defend their proposals.

In small organizations, urban planners must be able to do several kinds of work. In large organizations, planners usually specialize in areas such as physical design, community relations, or the reconstruction of run-down business districts.

Places of Employment

About 16,000 persons were urban planners in 1976. Most work for city, county, or regional planning agencies. A growing number are employed by States or by the Federal Government in agencies dealing with housing, transportation, or environmental protection.

Many planners do consulting work, either part time in addition to a regular job, or full time working for a firm that provides services to private developers or government agencies. Urban planners also work for large land developers or research organizations and teach in colleges and universities.

Training, Other Qualifications, and Advancement

Employers often seek workers who have advanced training in urban planning. Most entry jobs in Federal, State, and local government agencies require 2 years of graduate study in urban or regional planning, or the equivalent in work experience. Although the master's degree in planning is the usual requirement at the entry level, some people who have a bachelor's degree in city planning, architecture, landscape architecture, or engineering may qualify for beginning positions.

In 1976, over 80 colleges and universities gave a master's degree in urban planning. Although students holding a bachelor's degree in architecture or engineering may earn a master's degree after 1 year, most graduate programs in urban planning require 2 or 3 years to complete. Graduate students spend considerable time in workshops or laboratory courses learning to analyze and solve urban planning problems. Students often are required to work in a planning office part time or during the summer while they are earning the graduate degree.

Candidates for jobs in Federal, State, and local government agencies usually must pass civil service examinations to become eligible for appointment.

Planners must be able to think in terms of spatial relationships and to visualize the effects of their plans and designs. They should be flexible in their approaches to problems and be able to cooperate with others and reconcile different viewpoints to achieve constructive policy recommendations.

After a few years' experience, urban planners may advance to assignments requiring a high degree of independent judgment, such as outlining proposed studies, designing the physical layout of a large development, or recommending policy, program, and budget options. Some are promoted to jobs as planning directors, and spend a great deal of time meeting with officials in other organizations, speaking to civic groups, and supervising other professionals. Further advancement is more difficult at this level and often occurs through a transfer to a large city, where the problems are more complex and the responsibilities greater.

Employment Outlook

Employment of urban planners is expected to grow faster than the average for all occupations through the mid-1980's. In addition to openings created by future growth of this relatively small occupation, some jobs will open up because of the need to replace planners who leave their jobs.

Future growth of the occupation will depend to a great extent on the availability of money for urban planning projects. Growth in Federal support for State and local community development, urban restoration, and land use planning programs should increase requirements for urban planners. Many opportunities for planners should arise in fields in which they have not traditionally been employed, such as environmental and social service planning.

Earnings and Working Conditions

Starting salaries for urban planners ranged between $11,000 and $14,000 a year in 1976. Planners with a master's degree were hired by the Federal Government at $14,097 a year in 1977. In some cases, persons having less than 2 years of graduate work could enter Federal service as interns at yearly salaries of either $9,303 or $11,523.

State governments paid urban planners average beginning salaries of about $11,000 a year in mid-1976, although planners started at more than $14,000 in some States. Salaries of experienced State planners ranged from an average minimum of nearly $16,000 a year to an average maximum of more than $21,000 a year. Salaries of State planning directors ranged from an average minimum of about $24,000 to an average maximum of nearly $28,000 in mid-1976.

City, county, and other local governments paid urban planners average starting salaries exceeding $14,000 in 1976, although some communities in the East and South paid less. In 1976, experienced urban and regional planners generally earned more than one and one-half times as much as the average earnings for all nonsupervisory workers in private industry, except farming.

Most planners have sick leave and vacation benefits and are covered by retirement and health plans. Although most city planners have a scheduled workweek of 40 hours, they sometimes work in the evenings and on weekends to attend meetings with citizens' groups.

Sources of Additional Information

Facts about careers in planning and a list of schools offering training are available from:

American Institute of Planners, 1776 Massachusetts Ave. NW., Washington, D.C. 20036.

American Society of Planning Officials, 1313 East 60th St., Chicago, Ill. 60637.

SERVICE OCCUPATIONS

Workers in service occupations perform a wide variety of tasks ranging from policing streets and fighting fires to serving food and cleaning buildings. In 1976, about 12 million people were employed in service jobs. The major groups of service occupations are discussed below:

Food service occupations. The largest group of service workers, almost 4 million persons in 1976, prepared and served food in restaurants, cafeterias, schools, hospitals, and other institutions. Workers in this group included cooks and chefs, waiters and waitresses, bartenders, and kitchen workers.

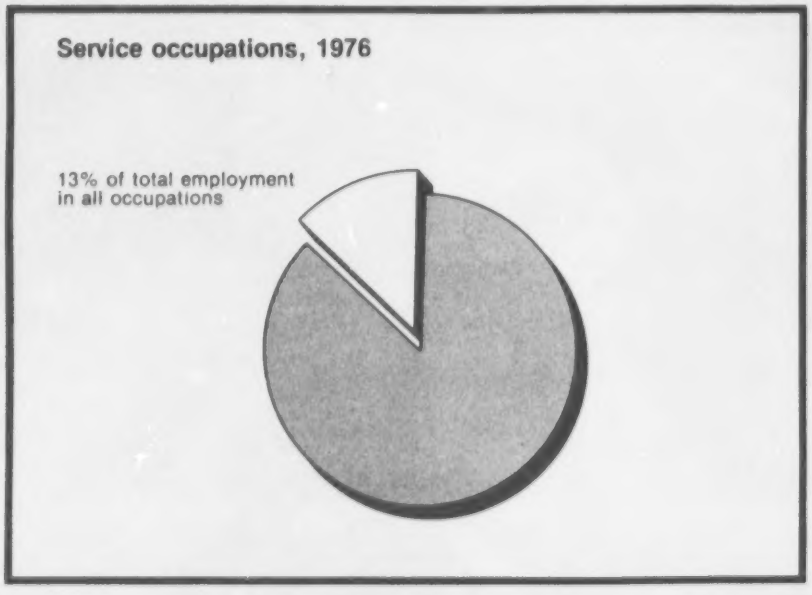
Cleaning and related occupations. Workers in these occupations clean and maintain buildings such as apartment houses, schools, and offices. Almost 2.3 million persons were employed in these jobs in 1976. The group included janitors, building custodians, and pest controllers.

Health service occupations. More than 1.7 million persons were employed as health service workers in jobs such as practical nurse or hospital attendant. Most of these workers were employed in hospitals, but some worked in doctors' or dentists' offices.

Personal service occupations. Workers in this group range from barbers and cosmetologists to ski instructors and theater ushers. About 1.6 million persons were employed in personal service jobs.

Protective and related service occupations. About 1.3 million persons were employed to safeguard lives and property in 1976. The majority were police officers, guards, or firefighters. Most police officers and detectives were government employees, but some worked for hotels, stores, and other businesses. Guards, another large group of protective service employees, worked chiefly for private companies to protect company property and enforce company rules and regulations. Firefighters worked mainly for city governments. The remaining protective service workers were sheriffs and bailiffs, crossing guards and bridge tenders, and marshals and constables.

Private household service occupations. Most of the 1.1 million private household workers employed in 1976 were domestic workers who cleaned their employer's home, prepared meals, and cared for children. Some worked as launderers, caretakers, and companions.

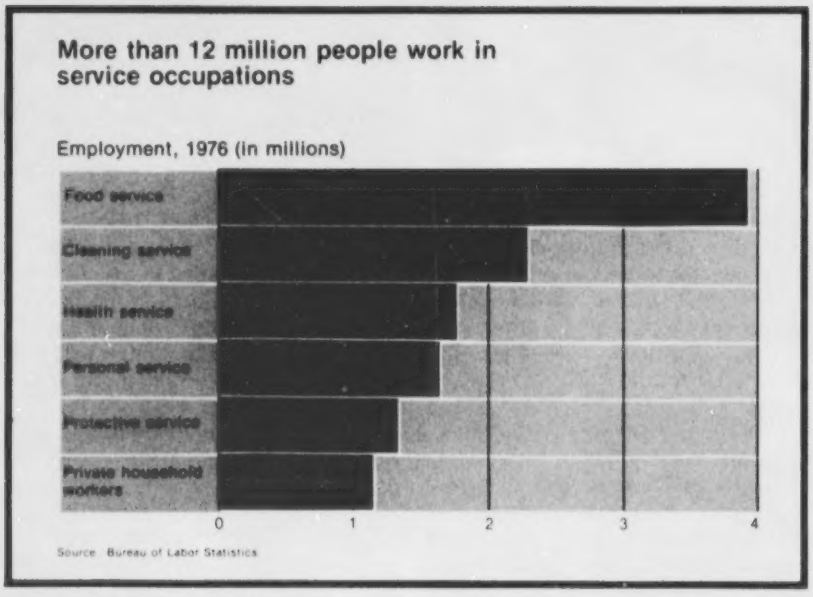


Training, Other Qualifications, and Advancement

Training and skill requirements differ greatly among the various service occupations. FBI special agents, for example, must have a college degree. Barbers and cosmetologists need specialized vocational training. Still other occupations—household worker, building custodian, and hotel bellhop, for example—have no specific educational requirements for entry, although a high school diploma is always an advantage.

For many service occupations, personality traits and special abilities may be as important as formal schooling. Thus, physical strength and endurance are a necessity for work as a porter, lifeguard, or window cleaner; and a pleasing manner and appearance are especially important for a waiter or waitress, elevator operator, or usher. Other service workers, such as store and hotel detectives and travel guides, need good judgment and should be skillful in dealing with people.

Some service workers eventually go into business for themselves as caterers or restaurant operators, for example, or proprietors of barber or beauty shops. Advancement from service occupations that require little training or skill may be difficult for people without a good basic education and some knowledge of the business in which they work.



Employment Outlook

Employment in the service occupations is expected to grow at about the same rate as the average for all occupations through the mid-1980's. The number of private household workers, however, has declined since the mid-1960's and this trend is expected to continue despite a strong demand for these workers. If private household workers are excluded from the total, service workers show a faster than average rate of growth.

Most of the future employment increase is expected to be among the health care and protective service occupations. Population growth and the aging of the population will create more demand for all health care occupations. More police officers and guards will be needed in the future as population increases and the need for protection against crime, theft, and vandalism continues to grow. Rising incomes, increasing leisure time, and the growing number of women who combine family responsibilities and a job are likely to cause the number of cooks and chefs to grow faster than the average.

The following sections of the *Handbook* contain detailed information on most of the service occupations mentioned here. Others are described in the industry statements on government; transportation, communications, and public utilities; wholesale and retail trade; and service and miscellaneous industries. The health service occupations are included in the section on health care occupations, and statements on meatcutters, pest controllers, and funeral directors can be found elsewhere in the *Handbook*.

CLEANING AND RELATED OCCUPATIONS

Every public building and apartment house needs to be kept clean and in good condition for the comfort and safety of the people who work or live there. Much of this work is done by persons in cleaning and related occupations. These workers may clean floors and windows in hospitals, change linens in hotels, repair broken faucets in apartments, or exterminate insects and rodents in office buildings.

Workers in these occupations usually learn their skills on the job, but other training is sometimes available. Building custodians may attend training programs offered by unions and government agencies; hotel housekeepers may take courses in housekeeping procedures and interior design offered by their employer. Workers who learn their jobs thoroughly and show that they can handle responsibility may advance to supervisory positions.

Besides a knowledge of their job, these workers must be courteous, tactful, and neat if their job requires contact with the public. Some perform monotonous and tiring tasks, such as scrubbing and waxing floors, and must be able to stand the boredom of the job.

This section describes three cleaning and related occupations: building custodians, pest controllers, and hotel housekeepers and assistants.

BUILDING CUSTODIANS

(D.O.T. 187.168, 381.137 and .887; 382.884, 891.138)

Nature of the Work

Building custodians, sometimes called janitors or cleaners, keep office buildings, hospitals, stores, and apartment houses clean and in good condition. They see that heating and ventilating equipment work properly, clean floors and windows, and do other necessary maintenance tasks. On a typical day, a custodian may wet- or dry-mop floors, vacuum carpets, dust furniture, make minor repairs, and exterminate insects and rodents.

Custodians use many different tools and cleaning materials. For one job they may need a mop and bucket; for another an electric polishing machine and a special cleaning solution. Chemical cleaners and power equipment have made many tasks easier and less time consuming, but custodians must know how to use them properly to avoid harming floors and fixtures.

Some custodians supervise a group of custodial workers and are responsible for maintaining a section of a building or an entire building. They assign tasks to each worker, give instructions, and see that jobs, such as floor waxing or window washing, are done well.

Places of Employment

In 1976, more than 2.1 million people worked as building custodians. One-third worked part time.

Most custodians worked in office buildings and factories, but schools, apartment houses, and hospitals also employed many. Some worked for firms supplying building maintenance services on a contract basis.

Although custodial jobs can be found in all cities and towns, most are located in highly populated areas where there are many office buildings, stores, and apartment houses.

Training, Other Qualifications, and Advancement

No special education is required for most custodial jobs, but the beginner should know simple arithmetic and be able to follow instructions. High school shop courses are helpful because minor plumbing or carpentry work may be a part of the job.

Most building custodians learn their skills on the job. Usually, beginners do routine cleaning and are given more complicated duties as they gain experience.

In some cities, unions and government agencies have developed programs to teach custodial skills. Students learn how to clean buildings thoroughly and efficiently, and how to operate and maintain machines, such as wet and dry vacuums, buffers, and polishers that they will use on the job. Instruction in minor electrical, plumbing, and other repairs is also given. As part of their training, students learn to plan their work, to deal with people in the buildings they clean, and to work without supervision.

Building custodians usually find work by answering newspaper advertisements, applying directly to a company where they would like to work, or applying to a building maintenance service. They also get jobs through State employment offices. Custodial jobs in the government are obtained by applying to the civil service personnel headquarters.

Advancement opportunities for custodial workers are usually limited because the custodian is the only maintenance worker in many buildings. Where there is a large mainte-

One-third of all building custodians work part time.

nance staff, however, custodians can be promoted to supervisory jobs. A high school diploma improves the chances for advancement. Some custodians go into the maintenance business for themselves.

Employment Outlook

Employment opportunities in this occupation are expected to be good through the mid-1980's. The need to replace workers who die, retire, or leave the occupation will create many jobs each year. Construction of new office buildings, hospitals and apartment houses will cause employment of custodians to grow about as fast as the average for all occupations.

Persons seeking part-time or evening work can expect to find many opportunities.

Earnings and Working Conditions

In 1976, building custodians averaged $3.63 an hour, which is about three-fourths as much as the average earnings for all nonsupervisory workers in private industry, except farming. Earnings, however, vary by industry and area of the country. Workers in large cities of the Northeast and North Central regions usually earn the highest wages.

Custodians working in the Federal Government are paid at the same rates offered by private industries in the local area.

Most building service workers receive paid holidays and vacations, and health insurance.

Because most office buildings are cleaned while they are empty, custodians often work evening hours. In buildings requiring 24-hour maintenance, custodians may work a night shift.

Although custodians usually work inside heated, well-lighted buildings, they sometimes work outdoors sweeping walkways, mowing lawns, or shoveling snow. Working with machines can be noisy and some tasks, such as cleaning bathrooms and trash rooms, can be dirty. Custodial workers often suffer minor cuts, bruises, and burns from machines, handtools, and chemicals.

Building custodians spend most of their time on their feet, sometimes lifting or pushing heavy furniture or equipment. Many tasks, such as dusting or sweeping, require constant bending, stooping, and stretching.

Sources of Additional Information

Information about custodial jobs and training opportunities may be obtained from the local office of your State employment service.

For general information on job opportunities in local areas, contact:

Service Employees International Union, 2020 K St. NW., Washington, D.C. 20006.

HOTEL HOUSEKEEPERS AND ASSISTANTS

(D.O.T. 321.138)

Nature of the Work

A hotel's or motel's reputation depends on how well it serves its guests. Although some offer economical accommodations and others stress luxurious surroundings and attentive service, all are concerned with their guests' comfort. Hotel housekeepers are responsible for keeping hotels and motels clean and attractive and providing guests with the necessary furnishings and supplies. It is their job to hire, train, schedule, and supervise the housekeeping staff, including linen and laundry workers, and repairers. They also keep employee records and order supplies. About 17,000 persons worked as hotel housekeepers in 1976.

Housekeepers who work in small or middle-sized establishments may not only supervise the housekeeping staff, but perform some of these duties themselves. In large or luxury hotels, their jobs are primarily administrative and they are frequently called executive or head housekeepers.

Besides supervising a staff that may number in the hundreds, executive housekeepers prepare the budget for their departments; submit reports to the general manager on the condition of rooms, needed repairs, and suggested improvements; and purchase supplies and furnishings. Executive housekeepers are assisted by floor housekeepers, who supervise the cleaning and maintenance of one or several floors in the hotel, and assistant executive housekeepers, who help with the administrative work.

Some large hotel and motel chains assign executive housekeepers to special jobs, such as reorganizing housekeeping procedures in an established hotel or setting up the

Hotel housekeepers are responsible for keeping hotels and motels clean and attractive.

housekeeping department in a new motel.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements for housekeepers, most employers prefer applicants who have at least a high school diploma. Experience or training in hotel housekeeping also is helpful in getting a job.

Several colleges, junior colleges, and technical insititutes offer instruction in hotel administration that includes courses in housekeeping; some of these courses are offered in summer or evening classes. Many schools have developed programs under the guidance and approval of the National Executive Housekeepers Association, an organization that confers certified membership status upon those members who complete certain education and experience requirements. In addition, the American Hotel and Motel Association offers courses for either classroom or home study. Most helpful are courses on housekeeping; personnel management; budget preparation; recordkeeping; interior decoration; safety practices; environmental controls; and the purchase, use, and care of different types of equipment and fabrics.

Executive housekeepers should be good at planning and organizing work and must be able to get along well with people, especially those they supervise. Housekeepers also should like to work independently and be able to keep records and analyze numbers.

Although assistant housekeepers may be promoted to executive housekeepers after several years of experience, opportunities are limited because only one executive housekeeper job is available in any hotel or motel. Those with degrees or courses in institutional housekeeping management may have the best advancement opportunities.

Employment Outlook

Employment of hotel housekeepers is expected to grow more slowly than the average for all occupations through the mid-1980's. Most openings will result from the need to replace workers who die, retire, or leave the occupation.

Because established hotels usually fill vacancies by promoting assistant housekeepers to executive housekeepers, beginners will find their best job opportunities in newly built motels or hotels.

See the statement on the Hotel Industry elsewhere in the *Handbook* for information on earnings and working conditions, sources of additional information, and more information on the employment outlook.

PEST CONTROLLERS

(D.O.T. 389.781 and 389.884)

Nature of the Work

Rats, mice, and common household insects such as flies and roaches contaminate food and spread sickness; termites can eat away houses. Protection of our health and property from these pests is the job of professional pest controllers, who are classified either as pest control route workers or termite specialists. Although these fields of work are separate, many controllers do both.

Often working alone, a pest control route worker usually begins the day by making sure the route truck has the necessary pesticides, sprayers, traps, and other supplies for servicing customers' facilities. With the supervisor's instructions, the route worker starts out to visit the 5 to 15 customers on the route list.

A route worker generally services restaurants, hotels, food stores, homes, and other facilities that have problems with rats, mice, or insects. Commercial customers commonly have service contracts calling for regular visits, such as once a month. Service to homes usually is less frequent, or only as required.

A route worker, who must know pests' habits and hiding places, carefully inspects the facility to determine the extent of the pest problem.

Pest controllers know the habits and hiding places of different insects.

To eliminate pests and prevent their return, the route worker sprays pesticides in and around areas such as cabinets and sinks where insects usually live, and sets traps and poisonous bait near areas where rats or mice nest and along paths they travel.

While regular visits are of help, the route worker may suggest to customers ways to eliminate conditions that attract pests. They may, for example, recommend replacing damaged garbage containers, sealing open food containers, and repairing cracks in walls.

Termite specialists are pest controllers who work to eliminate termites and prevent them from reaching wood structures. Termites eat wood. Without proper controls, these insects can go virtually unnoticed while they severely undermine the wood structure of a home or other building.

Termite specialists, usually working in pairs, can effectively control termites by providing a barrier between the termites' underground colonies and the wood structure. The most common barrier is termite poison.

To provide a poisonous barrier, they stick a steel nozzle into the ground and pump poison through a hose attached to the nozzle. Pumping forces the poison through the holes in the nozzle and into the soil. They repeat the process at numerous points around the foundation. To reach soil beneath or behind cement or other surfaces, they drill holes through the surface, insert the nozzle into the soil, and pump in the poison. Workers then seal these holes with cement. Specialists also may spray poison directly to the wood's surface. This is done commonly on older, all-wood structures.

Since termites will not cross poisonous areas, those termites in the ground must find food elsewhere or starve while those trapped in the wood structure die from lack of moisture. Because barriers last for years, termite specialists seldom need to revisit a treated facility.

Termite specialists sometimes have to alter buildings to prevent pests from returning. For example, they may remove and rebuild foundations or insulate wood-to-earth contacts with concrete.

Helpers assist termite specialists by digging around and underneath houses, helping set up and operate equipment, mixing cement, and doing general cleanup work.

Some highly experienced specialists inspect houses for termites, estimate costs, and explain the proposed work to customers. In most exterminating firms, however, managers, supervisors, or pest control sales workers do these jobs.

Places of Employment

More than half of the estimated 27,000 pest controllers employed in 1976 were route workers; the rest were termite specialists and combination route workers-termite specialists.

Most pest controllers work for or own firms that specialize in this service. A small number work for Federal, State, and local governments.

Jobs in this field can be found throughout the country. Employment, however, is concentrated in major metropolitan areas and large towns.

Training, Other Qualifications, and Advancement

Beginning pest controllers are trained by supervisors and experienced workers. Many large firms also provide several weeks of training, which includes classes on the characteristics of termites or other pests, the safe and effective use of pesticides, customer relations, and the preparation of work records. To aid beginners, many employers provide training manuals. Beginners gain practical experience by helping pest control route workers or termite specialists on the job. They can learn many of the basic concepts for pest control within 2 or 3 months. At this stage, however, they lack the experience to work alone.

Almost all States require pest controllers to pass a written test demonstrating competent and safe use of pesticides. Those few States not requiring a written test are expected within the next 3 years to pass legislation that would require pest controllers to pass a similar test. Currently, about 30 States require pest controllers be licensed, which in most States is only for registration.

Employers prefer trainees who are high school graduates, have safe driving records, and are in good health. Many firms require their employees to be bonded; applicants for these jobs must have a record of honesty and respect for the law. Because route workers frequently deal with customers, employers look for applicants who are courteous, tactful, and well-groomed. Termite specialists need manual dexterity and mechanical ability. Some firms give aptitude tests to determine an applicant's suitability for the work.

High school courses in chemistry and business arithmetic provide a helpful background for pest controllers. Students interested in becoming route workers also may benefit from courses in sales. Those interested in becoming termite specialists can gain valuable experience by taking courses related to building construction such as carpentry.

Experienced workers with ability can advance to higher paying positions, such as service manager or pest-control sales worker.

Employment Outlook

Employment of pest controllers is expected to grow faster than the average for all occupations through the mid-1980's. In addition to the jobs resulting from employment growth, the need to replace experienced workers who retire or die or transfer to other occupations also will create many job openings.

Because pests reproduce rapidly and tend to develop resistance to pesticides, their control is a never-ending problem. Population growth and further congestion of metropolitan areas will add to the need for more pest controllers. The deterioration of older buildings also is increasing the need for these workers since buildings become more prone to infestation as they age.

Earnings and Working Conditions

The starting pay for inexperienced trainees ranged from $3 to $4 an

hour in 1976, based on the limited information available. Earnings of experienced pest controllers ranged from $5 to $8 an hour.

Some route workers are paid an hourly rate or weekly salary. Others receive a commission based upon charges to customers. Nearly all termite specialists are paid an hourly rate or weekly salary.

On the average, pest controllers work 40 to 44 hours a week. During spring and summer, however, hours may be longer because pests are more prevalent. Most work is done during the day. Route workers, however, occasionally work nights because many restaurants and stores do not want them to work while customers are present.

Pest controllers work both indoors and outdoors in all kinds of weather. They frequently lift and carry equipment and materials, but most items weigh less than 50 pounds. Route workers also do a great deal of walking and driving. Termite specialists occasionally must crawl under buildings and work in dirty, cramped spaces. Workers in these occupations are subject to some hazards. Although most pesticides are not harmful to humans, some can cause injury if they are inhaled or left on the skin. Such injuries, however, are avoided if safety precautions are followed. Termite specialists risk injury from power tools and sharp or rough materials in buildings.

Pest controllers are on their own to a great extent. They do not work under strict supervision and, within limits, may decide how they will handle a job.

Sources of Additional Information

Further information about opportunities in this field is available from local exterminating companies and the local office of the State employment service. General information about the work can be obtained from:

National Pest Control Association, Inc., 8150 Leesburg Pike, Vienna, Va. 22180.

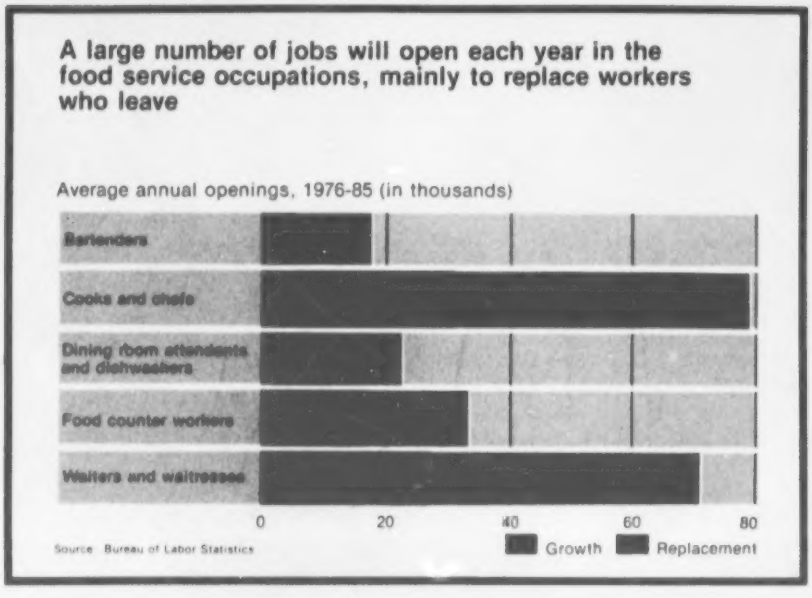
waitresses, cooks and chefs, and bartenders are presented in the statements that follow.

FOOD SERVICE OCCUPATIONS

Food service workers make up one of the largest and fastest growing occupational groups in the Nation's labor force. There are more than four times as many persons employed in food service as there are in automobile manufacturing and steel manufacturing combined. In 1976, about 3.9 million persons were employed in food service, mostly in restaurants, hotels, factory and school cafeterias, and catering firms. Job opportunities exist almost everywhere and for almost any interested person, including those with limited skills.

There are no specific educational requirements for most food service work and skills usually can be learned on the job. Many restaurants hire inexperienced persons for jobs as dining room attendants, dishwashers, food counter workers, waiters and waitresses, and bartenders. Experience sometimes is needed, however, to get one of these jobs in a large restaurant or catering firm. Persons who want to become cooks usually must have some prior experience in a food service occupation, such as kitchen helper or assistant cook. Experienced workers may advance to food service manager, maitre d'hotel, head cook, or chef.

Vocational schools, both public and private, offer courses in cooking, catering, and bartending. Employment of food service workers is expected to increase faster than the average for all occupations through the mid-1980's. The demand for these workers will increase as new restaurants, cafeterias, and bars open in response to population growth and increased spending for food and beverages outside the home. Higher average incomes and more leisure time will allow people to eat out more often. Also, as an increasing number of wives work, families are finding dining out a welcome convenience. Detailed discussions of the work, training, outlook, and earnings of dining room attendants and dishwashers, food counter workers, waiters and



BARTENDERS

(D.O.T. 312.878)

Nature of the Work

Cocktails range from the ordinary to the exotic. Bartenders make these concoctions by combining different kinds of liquor with other ingredients such as soft drinks, soda water, bitters, fruit juices, and cream. There are dozens of combinations, and each one can be made in several ways. Because some people have preferences for certain cocktail receipes, bartenders often are asked to mix drinks to suit a customer's taste. Besides cocktails, bartenders serve wine, draft or bottled beer, and a wide variety of nonalcoholic beverages.

Most bartenders take orders, serve drinks, and collect payment from customers. Others simply make

Bartenders often are asked to mix drinks to suit a customer's taste.

drinks for waiters and waitresses to serve.

Bartenders usually are responsible for ordering and maintaining an inventory of liquor, mixes, and other bar supplies. They also arrange bottles and glasses to form a display, wash glassware, and clean the bar.

Bartenders in large restaurants or hotels usually have *bartender helpers* (D.O.T. 312.887) to assist them with their duties. Helpers keep the bar supplied with liquor, mixes, and ice; stock refrigerators with wine and beer; and replace empty beer kegs with full ones. They also keep the bar area clean and remove empty bottles and trash.

Places of Employment

Most of the 261,000 bartenders employed in 1976 worked in restaurants and bars, but many also had jobs in hotels and private clubs. Roughly one-fifth were self-employed.

Several thousand people, many of whom have full-time jobs in other occupations or attend college, tend bar part time. Part-time workers often serve at banquets and private parties.

Most bartenders work in the urban population centers of New York, California, and other large States, but many are employed in small communities also. Vacation resorts offer seasonal employment, and some bartenders alternate between summer and winter resorts rather than remain in one area the entire year.

Training, Other Qualifications, and Advancement

Most bartenders learn their trade on the job. Although preparing drinks at home can be good practice, it does not qualify a person to be a bartender. Besides knowing a variety of cocktail recipes, bartenders must know how to stock a bar properly and be familiar with State and local laws concerning the sale of alcoholic beverages.

Persons who wish to become bartenders can get good experience by working as bartender helpers, dining room attendants, waiters, or waitresses. By watching the bartender at work, they can learn how to mix drinks and do other bartending tasks.

Some private schools offer short courses in bartending that include instruction on State and local laws and regulations, cocktail recipes, attire and conduct, and stocking a bar. Some of these schools help their graduates find jobs.

Bartenders should have pleasant personalities and be neat and clean in personal appearance because they deal with the public. They need physical stamina, since they stand while they work and also may have to lift heavy beer kegs or boxes of beverages.

Generally, bartenders must be at least 21 years of age, although some employers prefer those who are 25 or older. Some States require bartenders to have health certificates assuring that they are free from contagious diseases. In some instances, they must be bonded.

Small restaurants, neighborhood bars, and resorts usually offer a beginner the best entry opportunities. After gaining experience, a bartender may wish to work in a large restaurant or cocktail lounge where pay is higher and promotion opportunities are greater. Although promotional opportunities in this field are limited, it is possible to advance to head bartender, wine steward, or beverage manager. Some bartenders open their own business.

Employment Outlook

Employment of bartenders is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to the job openings caused by employment growth, several thousand will arise annually from the need to replace experienced bartenders who retire, die, or leave the occupation for other reasons.

The demand for bartenders will increase as new restaurants, hotels, and bars open in response to population growth and as the amount spent for food and beverages outside the home increases. Higher average incomes and more leisure time will allow people to go out for dinner or cocktails more often, and to take more vacations. Also, as more wives work, families are finding dining out a welcome convenience.

Job opportunities for bartenders should be especially favorable in States that have recently liberalized their drinking laws. In the early 1970's, 25 States either lowered the drinking age or legalized the sale of liquor by the drink, or both, and some other States may follow suit.

Earnings and Working Conditions

Hourly earnings of bartenders ranged from $2.86 to $5.33 in 1976, according to limited data from union contracts in the restaurant industry. Besides wages, bartenders may receive tips that increase their earnings.

Bartenders usually receive free meals at work and may be furnished bar jackets or complete uniforms.

Many bartenders work more than 40 hours a week, and night and weekend work and split shifts are common. For many bartenders, however, the opportunity for friendly conversation with customers and the possibility of someday managing or owning a bar or restaurant more than offset these disadvantages. For others, the opportunity to get part-time work is important.

Sources of Additional Information

Information about job opportunities may be obtained from the Hotel and Restaurant Employees and Bartenders International Union, which is the principal union organizing bartenders, and from the State employment service.

For general information on job opportunities in bartending, write to:

Culinary Institute of America, P.O. Box 53, Hyde Port, N.Y. 12538.

COOKS AND CHEFS

(D.O.T. 313.131 through .887; 314.381 through .878; and 315.131 through .381)

Nature of the Work

A reputation for serving fine food is an asset to any restaurant, whether

A restaurant's reputation depends largely on the skills of its cooks.

it prides itself on "home cooking" or exotic foreign cuisine. Cooks and chefs are largely responsible for the reputation a restaurant acquires. Many chefs have earned fame for both themselves and the restaurants and hotels where they work because of their skill in creating new dishes and improving familiar ones.

A cook's work depends partly on the size of the restaurant. Many small restaurants offer a limited number of short order dishes that are relatively simple to prepare, plus pies and other baked goods bought from bakeries. One cook usually prepares all of the food with the aid of a short order cook and one or two kitchen helpers.

Large eating places usually have more varied menus and prepare more of the food they serve. Kitchen staffs often include several cooks, sometimes called assistant cooks, and many kitchen helpers. Each cook usually has a special assignment and often a special job title—pastry, fry, or sauce cook, for example. Head cooks or chefs coordinate the work of the kitchen staff, and often direct certain kinds of food preparation. They decide the size of servings, sometimes plan menus, and buy food supplies.

Places of Employment

About 1,065,000 cooks and chefs were employed in 1976. Most worked in restaurants and hotels, but many worked in schools, colleges, and hospitals. Government agencies, factories, private clubs, and many other kinds of organizations also employed cooks and chefs.

Training, Other Qualifications, and Advancement

Most cooks start work in an unskilled position such as kitchen helper and acquire their skills on the job. However, an increasing number of cooks are obtaining high school and post-high school vocational training in food preparation. Occasionally they are trained in apprenticeship programs offered by professional associations and trade unions, or in a 3-year apprenticeship program administered by an office of the American Culinary Federation in cooperation with local employers and junior colleges. A few are trained in programs that some large hotels and restaurants have for new employees.

Inexperienced workers usually can qualify as assistant or fry cooks after several months of on-the-job training, but acquiring all-round skills as head cook or chef in a fine restaurant often takes several years. A high school diploma is not required for most beginning jobs; it is recommended, however, for those planning careers as cooks or chefs. High school or vocational school courses in business arithmetic and business administration are helpful in becoming a cook or chef. High school students can get experience as a cook by working part time in a fast-food restaurant or other limited service operation.

Persons who have had courses in commercial food preparation will have an advantage when looking for jobs in large restaurants and hotels where hiring standards are often high. Some vocational programs in high schools offer this kind of training to students. More often, these courses, ranging from a few months to 2 years or more, and open in some cases only to high school graduates, are given by trade schools, vocational centers, junior colleges, universities, professional associations, hotel management groups, and trade unions. Training in supervisory and management skills sometimes is emphasized by private vocational schools in courses offered by professional associations, and in university programs. The Armed Forces are also a good source of training and experience in food service work.

Although curricula may vary, students usually spend most of their time learning to prepare food through actual practice in well-equipped kitchens. They learn to bake, broil, and otherwise prepare food, and to use and care for kitchen equipment. Training programs often include courses in selection and storage of food, use of leftovers, determination of portion size, menu planning, and purchasing food supplies in quantity. Students also learn hotel and restaurant sanitation and public health rules for handling food.

Many school districts in cooperation with school foodservices divisions of State departments of education provide on-the-job training and sometimes summer workshops for cafeteria workers who wish to become cooks. Some junior colleges, State departments of education, and school associations also provide such training. School cooks often are selected from employees who have participated in these training programs.

Persons who want to become cooks or chefs should like to work with people in a team relationship and be able to work under pressure during busy periods and in close quarters. Cleanliness and a keen sense of taste and smell and the physical stamina to stand for hours at a time also are important qualifications. Most States require health certificates indicating that cooks and chefs are free from contagious diseases.

Advancement opportunities for cooks are better than for most other food service occupations. Many cooks acquire higher paying positions and new cooking skills by moving from restaurant to restaurant. Others gradually advance to chef positions or supervisory or management positions, particulary in hotels, clubs, or the larger, more elegant restaurants. Some eventually go into business as caterers or restaurant owners; others may become instructors in vocational programs in high schools, junior and community colleges, and other academic institutions.

Employment Outlook

Employment of cooks and chefs is expected to increase faster than the average for all occupations through the mid-1980's. In addition to employment growth, thousands of job openings will arise annually from the need to replace experienced workers who retire, die, or transfer to other occupations. Small restaurants, school cafetrias, and other eating places with simple food preparation will provide the greatest number of starting jobs for cooks.

The demand for cooks and chefs will increase as population grows and people spend more money on eating out. Higher personal incomes and more leisure time will allow people to go out for dinner more often and to take more vacations. Also, as an increasing number of wives work, more families are finding dining out a welcome convenience.

Earnings and Working Conditions

In 1976, hourly pay rates ranged from $3.11 to $6.01 for chefs, from $2.81 to $5.19 for cooks of various types, and from $2.02 to $4.05 for assistant cooks, according to limited data from union contracts in several large metropolitan areas.

Wages of cooks and chefs vary depending on the part of the country and the type of establishment in which they work. Wages generally are higher in the West and in large, well-known restaurants and hotels. Cooks and chefs in famous restaurants earn much more than the minimum rates and several chefs with national reputations earn more than $40,000 a year. Hours in restaurants may include late evening, holiday, and weekend work, and range from 37 1/2 to 48 hours a week. Cooks employed in public and private schools work regular school hours during the school year only, usually for 9 months.

Many kitchens are air-conditioned and have convenient work areas and modern equipment. Others, particularly in older or smaller eating places, are often not as well equipped and working conditions may be less desirable. In all kitchens, however, cooks must stand most of the time, lift heavy pots and kettles, and work near hot ovens and ranges.

The principal union organizing cooks and chefs is the Hotel and Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the Hotel and Restaurant Employees and Bartenders International Union, and local offices of the State employment service.

General information about restaurant cooks and chefs is available from:

Culinary Institute of America, P.O. Box 53, Hyde Park, N.Y. 12538.

Educational Director, National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

The Educational Institute, American Hotel and Motel Association, 1407 S. Harrison Rd., Michigan State University, Stephen S. Nisbet Bldg., East Lansing, Mich. 48823.

For information on the American Culinary Federation's apprenticeship program for cooks and chefs, write to:

American Culinary Federation, Educational Institute, 1407 S. Harrison Rd., East Lansing, Mich. 48823.

DINING ROOM ATTENDANTS AND DISHWASHERS

(D.O.T. 311.878 and 381.887)

Nature of the Work

Clean and attractive table settings are as important to a restaurant's reputation as the quality of food it serves. An egg-stained fork, a soiled tablecloth, or an empty salt shaker can make a customer unhappy. Dining room attendants and dishwashers provide the quick hands and sharp eyes needed to prevent such problems.

Attendants do many jobs that otherwise waiters and waitresses would have to do. They clear and reset tables, carry dirty dishes from the dining area to the kitchen and return with trays of food, and clean up spilled food and broken dishes. By taking care of these details, attendants give waiters and waitresses more time to serve customers.

In some restaurants, attendants also help by serving water and bread and butter to customers. When business is light, they do odd jobs like refilling salt and pepper shakers and cleaning coffee urns.

Dishwashers pick up where the attendants leave off—with the dirty dishes. They operate special machines that clean silverware and dishes quickly and efficiently. Occasionally, they may have to make minor adjustments to keep machines operating properly. Dishwashers scrub large pots and pans by hand. In addition, they clean refrigerators and other kitchen equipment, sweep and mop floors, and carry out trash.

Places of Employment

About 250,000 dishwashers and 190,000 attendants were employed in 1976. Many worked only part time.

Most attendants and dishwashers work in restaurants, bars, and hotels. Dishwashers also work in schools and hospitals.

Training, Other Qualifications, and Advancement

A high school education is not needed to qualify for jobs as dining room attendants and dishwashers, and many employers will hire applicants who do not speak English. Attendants and dishwashers must be in good physical condition and have physical stamina because they stand most of the time, lift and carry trays, and work at a fast pace during busy periods. State laws often require them to obtain health certificates to show that they are free of contagious diseases. Because of their close contact with the public, it is important that attendants have a neat appearance and the ability to get along with people.

Promotions for dining room attendants and dishwashers are limited. Attendants sometimes advance to positions as waiter or waitress, and dishwashers occasionally advance to cook's helper or short-order cook. The ability to read, write, and do simple arithmetic is required for promotion. Advancement opportunities generally are best in large restaurants.

Employment Outlook

Job openings for dining room attendants and dishwashers are expected to be plentiful in the years ahead. Most openings will result from the need to replace workers who find jobs in other occupations, retire, or die. Turnover is particularly high among part-time workers. About one-half of the attendants and dishwashers are students, most of whom work part time while attending school and then find other jobs after graduation.

Additional openings will result from employment growth. Employment of dining room attendants is expected to increase faster than the average for all occupations and employment of dishwashers is expected to grow about as fast as the average for all occupations through the mid-1980's as population growth and higher incomes create more business for restaurants.

Earnings and Working Conditions

Dining room attendants and dishwashers have relatively low earnings. Limited data from union contracts that cover restaurants and bars in several large cities indicate that hourly rates for these workers ranged from $1.46 to $3.75 in 1976. These amounts were below the average earnings of most other nonsupervisory workers in private industry, except farming.

Attendants may receive a percentage of waiters' and waitresses' tips in addition to wages. Tips often average between 10 and 20 percent of patrons' checks.

The majority of employers provide free meals at work and furnish uniforms. Paid vacations are customary, and various types of health insurance and pension plans may be offered.

Most attendants and dishwashers work less than 30 hours a week. Some are on duty only a few hours a day during either the lunch or dinner period. Others work both periods but may take a few hours off in the middle of the day. Weekend and holiday work often is required.

Attendants and dishwashers must have good health and physical stamina.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the Hotel and Restaurant Employees and Bartenders International Union, and local offices of the State employment service. Names of local unions can be obtained from:

Hotel and Restaurant Employees and Bartenders International Union, 120 East 4th St., Cincinnati, Ohio 45202.

For general information about dining room attendants and dishwashers, write to:

Educational Director, National Institute for the Food Service Industry, 120 S. Riverside Plaza, Chicago, Ill. 60606.

Culinary Institute of America, P.O. Box 53, Hyde Park, N.Y. 12538.

FOOD COUNTER WORKERS

(D.O.T. 311.878 and 319.878)

Nature of the Work

Counter workers serve customers in eating places that specialize in fast service and inexpensive food, such as hamburger and fried chicken carryouts, drugstore soda fountains, and school and public cafeterias. About 420,000 persons, most of whom worked part time, had food counter jobs in 1976.

Typical duties of counter workers include taking customers' orders, serving food and beverages, making out checks, and taking payments. At drugstore fountains and in diners, they also may cook, make sandwiches and cold drinks, and prepare sundaes and other ice cream dishes. In hamburger carryouts, where food is prepared in an assembly-line manner, counter workers may take turns waiting on customers, making french fries, toasting buns, and doing other jobs.

Counter workers in cafeterias fill plates for customers and keep the serving line supplied with desserts, salads, and other dishes. Unlike other counter workers, they usually do not take payments and make change.

Counter workers also do odd jobs, such as cleaning kitchen equipment, sweeping and mopping floors, and carrying out trash.

Training, Other Qualifications, and Advancement

In the counter jobs that require totaling bills and making change, employers prefer to hire persons who are good in arithmetic and have attended high school, although a diploma usually is not necessary. Managers of fast-food restaurants often hire young people still in high school as part-time counter workers. There usually are no specific educational requirements for counter jobs in cafeterias.

Many large companies, such as the nationwide hamburger carryout chains, operate formal management training programs. Counter workers who show leadership ability may qualify for these programs.

Because counter workers deal with the public, a pleasant personality and neat appearance are important. Good health and physical stamina also are needed because they stand most of the time and work at a fast pace during busy periods. State laws often require counter workers to obtain health certificates to show that they are free of contagious disease.

Opportunities for advancement are limited, especially in small eating places. Some counter workers move into higher paying jobs and learn new skills by transferring to a larger restaurant. Advancement can be to cashier, cook, waiter or waitress, counter or fountain supervisor, or, in the case of counter workers in cafeterias, to line supervisor or merchandiser (person in charge of stocking food).

Most counter workers learn their skills on the job by observing and working with more experienced workers. Some employers, including some fast-food restaurants, use self-study instructional booklets and audio-visual aids to train new employees.

Employment Outlook

Job openings for food counter workers are expected to be plentiful in the years ahead. Most openings will result from turnover—replacement of workers who find jobs in other occupations, retire, or die. Many counter workers are high school and college students who work part time while attending school and find jobs in other occupations after graduation. Because of the high turnover, jobs for counter workers are relatively easy to find.

Additional job openings will result from employment growth. Employment is expected to increase faster than the average for all occupations through the mid-1980's, as population growth and higher incomes create more business for eating places.

Earnings and Working Conditions

Hourly rates for food counter workers ranged from $1.67 to $3.79 in 1976, based on limited data from union contracts that covered eating places in several large cities. These amounts were well below the average earnings for most other nonsupervisory workers in private industry, except farming. However, some counter workers, such as those in drugstores and diners, receive tips which can be greater than hourly

Flexible schedules often allow students to fit their working hours around their classes.

wages. Tips usually average between 10 and 20 percent of patrons' checks. Counter workers usually receive free meals at work, and may be furnished with uniforms.

Most counter workers work less than 30 hours a week. Some are on duty only a few hours a day for either the lunch or dinner period. Many others work both periods, but may take a few hours off in the middle of the day. Flexible schedules often allow students to fit their working hours around their classes. Weekend and holiday work often is required.

Job hazards include the possibility of falls, cuts, and burns, but injuries seldom are serious.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the Hotel and Restaurant Employees and Bartenders International Union, and local offices of the State employment service. Names of local unions are available from the Hotel and Restaurant Employees and Bartenders International Union, 120 East 4th St., Cincinnati, Ohio 45202.

For general information about food counter workers, write to:

Educational Director, National Institute for the Food Service Industry, 120 S. Riverside Plaza, Chicago, Ill. 60606.

Culinary Institute of America, P.O. Box 53, Hyde Park, N.Y. 12538.

MEATCUTTERS

(D.O.T. 316.781 and .884)

Nature of the Work

Meatcutters prepare meat, fish, and poultry in supermarkets or wholesale food outlets. Their primary duty is to divide animal quarters and carcasses into steaks, roasts, chops, and other serving-sized portions. They also may prepare meat products such as sausage and corned beef. Cutters who work in retail foodstores may set up counter displays and wait on customers.

In preparing beef quarters, meatcutters divide them into primal cuts such as rounds, loins, and ribs with a band saw, and then use knives or saws to divide these large cuts into customer-sized cuts such as steaks, roasts, and chops. Meatcutters use knives or slicers or power cutters to divide boneless cuts and a band saw or cleaver to divide pieces that contain bones. Any bone chips left on the meat are scraped off with a knife or brushed off by a machine. Cutters grind trimmings into hamburger.

Places of Employment

About 215,000 persons worked as meatcutters in 1976. They had jobs in almost every city and town in the Nation. Most meatcutters worked in retail foodstores. A few worked in wholesale stores, restaurants, hotels, hospitals, and other institutions.

Training, Other Qualifications, and Advancement

Most meatcutters acquire their skills on the job. Although many are informally trained, most learn through apprenticeship programs. A few meatcutters learn their skills by attending private schools specializing in this trade.

Generally, on-the-job trainees begin by doing odd jobs, such as removing bones and fat from retail cuts. Under the guidance of skilled meatcutters, they learn about the various cuts and grades of meats and the proper use of tools and equipment. After demonstrating skill with tools, they learn to divide quarters into pri-

Meatcutters acquire their skills on the job either informally or through apprenticeship programs.

mal cuts and to divide primal cuts into individual portions. Trainees may learn to cut and prepare fish and poultry, roll and tie roasts, prepare sausage, and cure and corn meat. Later, they may learn marketing operations such as inventory control, meat buying and grading, and recordkeeping.

Meatcutters who learn the trade through apprenticeship generally complete 2 to 3 years of supervised on-the-job training that may be supplemented by some classroom work. At the end of the training period, apprentices are given a meatcutting test which is observed by their employer. A union member also is present in union shops. Apprentices who pass the test qualify as meatcutters. Those who fail can take the test again at a later time. In many areas, apprentices may become meatcutters in less than the usual training time if they can pass the test.

Employers prefer applicants who have a high school diploma and the potential to develop into meat department managers. High school or vocational school courses in business arithmetic are helpful in weighing and pricing meats and in making change.

Manual dexterity, good depth perception, color discrimination, and good eye-hand coordination are important in cutting meat. A pleasant personality, a neat appearance, and the ability to communicate clearly also are important qualifications when cutters wait on customers. Better than average strength is needed to lift heavy pieces of meat. In some communities, a health certificate may be required for employment.

Meatcutters may progress to supervisory jobs, such as meat department managers in supermarkets. A few become meat buyers for wholesalers and supermarket chains. Some cutters become grocery store managers or open their own meat markets.

Employment Outlook

The number of meatcutters is expected to decline slightly through the mid-1980's. Nevertheless, thousands of entry jobs will be available as experienced workers retire, die, or leave the occupation for other reasons.

Employment of meatcutters in food stores will be limited by central cutting—the practice of cutting and wrapping meat for several stores at one location. Central cutting, which permits meatcutters to specialize in both a type of meat and a type of cut, increases efficiency. In addition, more central cutting is expected to be done in meatpacking plants, thus reducing the amount of meat cut—and the need for meatcutters—in food stores.

Earnings and Working Conditions

Hourly earnings of most meatcutters averaged $7.10 in 1976, according to a 1975 survey of union wage rates for grocery store employees in cities of 100,000 inhabitants or more. Meatcutters working in cities with 500,000 inhabitants or more tended to earn more than those in smaller cities. Among grocery store occupations, meatcutters have the highest wages.

Beginning apprentices usually receive between 60 and 70 percent of the experienced cutter's wage and generally receive increases every 6 to 8 months.

Cutters work in coldrooms designed to prevent meat from spoiling. They must be careful when working with sharp tools, especially those that are powered.

Most cutters are members of the Amalgamated Meat Cutters and Butcher Workmen of North America.

Sources of Additional Information

Information about work opportunities can be obtained from local employers or local offices of the State employment service. For information on training and other aspects of the trade, contact:

Amalgamated Meat Cutters and Butcher Workmen of North America, 2800 North Sheridan Rd., Chicago, Ill. 60657.

WAITERS AND WAITRESSES

(D.O.T. 311.138 through .878)

Nature of the Work

Waiters and waitresses take customers' orders, serve food and beverages, make out checks, and sometimes take payments. In diners, coffee shops, and other small restaurants they provide fast, efficient service. In other restaurants, waiters and waitresses serve food at a more leisurely pace and offer more personal service to their customers. For example, they may suggest wines and explain the preparation of items on the menu.

Waiters and waitresses may have duties other than waiting on tables. They set up and clear tables and carry dirty dishes to the kitchen. In very small restaurants they may combine waiting on tables with counter service, preparing sandwiches, or cashiering. In large restaurants and in places where meal service is formal, waiters and waitresses are relieved of most additional duties. Dining room attendants often set up tables, fill water glasses, and do other routine tasks.

Places of Employment

About 1,260,000 waiters and waitresses were employed in 1976. More than half worked part time (less than 35 hours a week). Most worked in restaurants; some worked in hotels, colleges, and factories that have restaurant facilities. Jobs are located throughout the country but are most plentiful in large cities and tourist areas. Vacation resorts offer seasonal employment and some waiters and waitresses alternate between summer and winter resorts instead of remaining in one area the entire year.

Training, Other Qualifications, and Advancement

Most employers prefer to hire applicants who have had at least 2 or 3 years of high school. A person may start as a waiter or waitress, or advance to that position after working as a dining room attendant, car hop, or soda fountain worker. Although most waiters and waitresses pick up their skills on the job, at least 3 months' experience is preferred by larger restaurants and hotels. Some public and private vocational

More than one-half of all waiters and waitresses work part time.

schools, restaurant associations, and some large restaurant chains provide classroom training. Other employers use self-instruction programs to train new employees. In these programs, an employee learns food preparation and service skills by observing film strips and reading instructional booklets.

Because people in this occupation are in close and constant contact with the public, a neat appearance and an even disposition are important qualifications. Physical stamina also is important, as waiters and waitresses are on their feet, lifting and carrying trays of food from kitchen to table, for hours at a time. Waiters and waitresses also should be good at arithmetic and, in restaurants specializing in foreign foods where customers may not speak English, knowledge of a foreign language is helpful. State laws often require waiters and waitresses to obtain health certificates showing that they are free of contagious diseases.

Opportunities for promotion in this occupation are limited, due to the small size of most food-serving establishments. After gaining experience, however, a waiter or waitress may transfer to a larger restaurant where earnings and prospects for advancement may be better. The most successful waiters and waitresses are those who genuinely like people, are interested in offering service, and possess the ability to sell rather than just take orders. Advancement can be to cashier or supervisory jobs, such as maitre d'hotel or dining room supervisor. Some supervisory workers advance to jobs as restaurant managers.

Employment Outlook

Job openings are expected to be plentiful in the years ahead, mainly due to the need to replace the waiters and waitresses who find other jobs or who retire, die, or stop working for other reasons. Turnover is particularly high among part-time workers. About one-fourth of the waiters and waitresses are students, most of whom work part time while attending school and then find other jobs after graduation. In addition to the job openings from turnover, many will result from employment growth.

Employment of waiters and waitresses is expected to grow about as fast as the average for all occupations through the mid-1980's, as population growth and higher incomes create more business for restaurants. Higher incomes and more leisure time will permit people to eat out more often. Also, as an increasing number of wives work, more and more families may find dining out a welcome convenience.

Beginners will find their best opportunities for employment in the thousands of informal restaurants. Those who seek jobs in expensive restaurants may find keen competition for the jobs that become available.

Earnings and Working Conditions

Hourly rates for waiters and waitresses (excluding tips) ranged from $1.25 to $3.33 in 1976, according to limited data from union contracts that covered eating and drinking places in several large cities. For many waiters and waitresses, however, tips are greater than hourly wages. Tips generally average between 10 and 20 percent of guests' checks. Most waiters and waitresses receive meals at work and many are furnished with uniforms.

Some waiters and waitresses work split shifts—that is, they work for several hours during the middle of the day, take a few hours off in the afternoon, and then return to their jobs for the evening hours. They also may work on holidays and weekends. The wide range in dining hours creates a good opportunity for part-time work. Waiters and waitresses stand most of the time and often have to carry heavy trays of food. During dining hours they may have to rush to serve several tables at once. The work is relatively safe, but they must be careful to avoid slips or falls, and burns.

The principal union organizing waiters and waitresses is the Hotel and Restaurant Employees and Bartenders International Union.

Sources of Additional Information

Information about job opportunities may be obtained from local employers, locals of the union previously mentioned, and local offices of the State employment service. General information on waiter and waitress jobs is available from:

National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

The Educational Institute, American Hotel and Motel Association, 1407 S. Harrison Rd., Michigan State University, East Lansing, Mich. 48823.

Culinary Institute of America, P.O. Box 53, Hyde Park, N.Y. 12538.

PERSONAL SERVICE OCCUPATIONS

Personal service workers perform a variety of tasks for people, such as styling or cutting hair, making airline passengers safe and comfortable, conducting tours, carrying baggage, or arranging funerals. Some of these tasks require special skills that must be learned through formal training. Others require skills that can be learned on the job. For some personal service jobs, workers must obtain a State license after completing a training program or apprenticeship.

Persons entering these occupations should be neat, tactful and able to get along well with people because success on the job depends on the impression personal service workers make on their customers. Physical stamina is necessary for those jobs that involve lifting heavy objects or standing for long periods of time.

Personal service workers may receive salaries, commissions or both. In many cases they also receive tips that add substantially to their income. Employers often furnish uniforms for jobs that require them. Some workers, like barbers and cosmetologists, must provide their own tools.

This section describes four personal service occupations: barbers, cosmetologists, funeral directors and embalmers, and bellhops and bell captains.

BARBERS

(D.O.T. 330.371)

Nature of the Work

Although most men go to a barber for just a haircut, other services such as hairstyling and coloring have become increasingly popular. Barbers trained in these areas are called "hairstylists" and work in styling salons, "unisex" salons, and some barbershops. They cut and style hair to suit each customer and may color or straighten hair and fit hair pieces. Most barbers offer hair and scalp treatments, shaves, facial massages, and shampoos.

A small but growing number of barbers cut and style women's hair. They usually work in unisex salons—shops that have male and female customers. Some States require a cosmetologist's license as well as a barber's license, however, to permanent wave or color women's hair.

As part of their responsibilities, barbers keep their scissors, combs, and other instruments sterilized and in good condition. They clean their work areas and may sweep the shop as well. Those who own or manage a shop have additional responsibilities such as ordering supplies, paying bills, keeping records, and hiring employees.

More than half of all barbers operate their own businesses.

Places of Employment

Most of the 124,000 barbers in 1976 worked in barbershops. Some worked in unisex salons, and a few worked for government agencies, hotels, or department stores. More than half of all barbers operated their own businesses.

Almost all cities and towns have barbershops, but employment is concentrated in the most populous cities and States. Hairstylists usually work in large cities where the greatest demand for their services exists.

Training, Other Qualifications, and Advancement

All States require barbers to be licensed. The qualifications necessary to get a license vary from one State to another, however. Generally a person must be a graduate of a State-approved barber school, have completed the eighth grade, pass a physical examination, and be at least 16 (in some States 18) years old.

Many States require a beginner to take an examination for an apprentice license, and serve 1 or 2 years as an apprentice before taking the examination required for a license as a registered barber. In the examinations, the applicant usually is required to pass a written test and demonstrate an ability to perform the basic services. Fees for these examinations range from $10 to $75.

Because most States do not recognize training, apprenticeship work, or licenses obtained in another State, persons who wish to become barbers should review the laws of the State in which they want to work before entering a barber school.

Barber training is offered in about 350 schools; 3 out of 4 barber schools are private. Some public high schools offer barbering in their vocational programs. Barber school programs usually last 9 to 12 months. Students buy their own tools, which cost about $200. They study the basic services—haircutting, shaving, facial massaging, and hair and scalp treatments—and, under supervision, practice on fellow students and on customers in school "clinics." Besides attending lectures on barber services and the use and care of instruments, students take courses in

sanitation and hygiene, and learn how to recognize certain skin conditions. Instruction also is given in selling and general business practices. Advanced courses are available in some localities for barbers who wish to update their skills or specialize in hairstyling, coloring, and the sale and service of hairpieces.

Dealing with customers requires patience and a better than average disposition. Good health and stamina also are important because barbers stand a great deal and work with both hands at shoulder level—a position that can be tiring.

Beginners may get their first jobs through the barber school they attended, or through the local barber's union or employer's association.

Some experienced barbers advance by becoming managers of large shops or by opening their own shops. A few may teach at barber schools. Barbers who go into business for themselves must have the capital to buy or rent a shop and install equipment. New equipment for a one-chair shop cost from $1,500 to $3,000 in 1976. Some shopowners buy used equipment and fixtures at reduced prices, however.

Employment Outlook

The employment decline of the last decade is expected to level off by the mid-1980's as population growth and the increasing popularity of hairstyling offset the effect of the fashion for longer hair. Although little change is expected in the level of employment, several thousand job openings for barbers will occur each year because of the need to replace workers who retire, die, or transfer to other kinds of work. Replacement needs in barbering are high, compared with many other occupations.

The shift in consumer preferences from regular haircuts to more personalized and intensive services has greatly affected the occupation. Barbers who specialize in hairstyling have been much more successful than those who offer conventional services. This trend is expected to continue, and employment opportunities should be better for hairstylists than for regular barbers.

Earnings and Working Conditions

Barbers receive income from commissions or wages and tips. Most barbers who are not shopowners normally receive 60 to 70 percent of the money they take in; a few are paid straight salaries.

Weekly earnings of experienced barbers (including tips) generally ranged between $200 and $250 in 1976, according to limited information available. Hairstylists usually earned $315 to $400 a week, because the services they provide are more personalized and therefore more expensive. Some hairstylists and a few barbers who operated their own shops earned more than $400 a week. Beginning barbers usually earn about $175 to $200 a week, hairstylists $200 to $250 a week.

Earnings depend on the size and location of the shop, customers' tipping habits, competition from other barbershops, and the barber's ability to attract and hold regular customers.

Most full-time barbers work more than 40 hours a week and a workweek of over 50 hours is not uncommon. Although Saturdays and lunch hours are generally very busy, a barber may have some time off during slack periods. To assure an even workload, some barbers ask customers to make appointments. Some barbers receive 1- or 2-week paid vacations, insurance, and medical benefits.

The principal union that organizes barbers—both employees and shopowners—is the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America. The principal association that represents and organizes shopowners, managers, and employees is the Associated Master Barbers and Beauticians of America.

Sources of Additional Information

Lists of barber schools, by State, are available from:

National Association of Barber Schools, Inc., 338 Washington Ave., Huntington, W.Va. 25701.

National Association of Trade and Technical Schools, 2021 L St., NW., Room 440, Washington, D.C. 20036.

Every State maintains information on State licensing requirements and approved barber schools. For details, contact the State board of barber examiners or the equivalent authority at your State capital.

Additional information on this occupation is available from:

National Barber Career Center, 3839 White Plains Rd., Bronx, N.Y. 10467.

BELLHOPS AND BELL CAPTAINS

(D.O.T. 324.138 and .878)

Nature of the Work

Bellhops carry baggage for hotel and motel guests and escort them to their rooms on arrival. When showing new guests to their rooms, bellhops make sure everything is in order and may offer information about valet services, dining room hours, or other hotel services. Bellhops also run errands for guests and may relieve elevator operators or switchboard operators.

Large and medium-sized hotels employ bell captains to supervise bellhops on the staff. They plan work assignments, record the hours each bellhop is on duty, and train new employees. Bell captains take care of any unusual requests guests may make and handle any complaints regarding their department. Sometimes they help arriving or departing guests if a bellhop is unavailable. In 1976, more than 16,000 persons worked as bellhops and bell captains.

A few hotels have large service departments and employ superintendents of service to supervise bell captains and bellhops, elevator operators, doorkeepers, and washroom attendants.

Training, Other Qualifications, and Advancement

No specific educational requirements exist for bellhops, although high school graduation improves the chances for promotion to a job as desk clerk or reservation clerk. Many hotels fill bellhop jobs by promoting elevator operators.

Because bellhops and captains have frequent contact with guests, they must be neat, tactful, and courteous.

Because bellhops have frequent contact with guests, they must be neat, tactful, and courteous. A knowledge of the local area is an asset because guests often ask about local tourist attractions, restaurants, and transportation services. Bellhops also must be able to stand for long periods, carry heavy baggage, and work independently.

Bellhops can advance to bell captain and then to superintendent of service, but opportunities are limited. Because there is only one bell captain position in each hotel, many years may pass before an opening occurs. Opportunities for advancement to superintendent of service are even fewer.

Employment Outlook

Little or no change in employment of bellhops is expected through the mid-1980's. Most openings will result from the need to replace workers who die, retire, or leave the occupation.

Although many motels now offer services similar to those of a hotel and employ bellhops, the growing popularity of economy motels that offer only basic services is expected to limit employment growth. New workers will have better opportunities in motels and small hotels because the large luxury hotels prefer to hire experienced workers. Opportunities also will be available in resort areas where hotels and motels are open only part of the year.

See the statement on the Hotel Industry elsewhere in the *Handbook* for information on earnings and working conditions, sources of additional information, and more information on employment outlook.

COSMETOLOGISTS

(D.O.T. 332.271 and .381; 331 and 339.371)

Nature of the Work

Hair has been a center of attention since women and men first began to care about their appearance. Throughout history a great deal of effort has gone into acquiring a fashionable hairstyle or a perfectly trimmed beard. Although styles change from year to year, the cosmetologist's task remains the same—to help people look attractive.

Cosmetologists, who also are called *beauty operators*, *hairstylists*, or *beauticians*, shampoo, cut, and style hair, and advise patrons on how to care for their hair. Frequently they straighten or permanent wave a patron's hair to keep the style in shape. Cosmetologists may also lighten or darken the color of the hair to better suit the patron's skin color. Cosmetologists may give manicures, scalp and facial treatments, provide make-up analysis for women, and clean and style wigs and hairpieces.

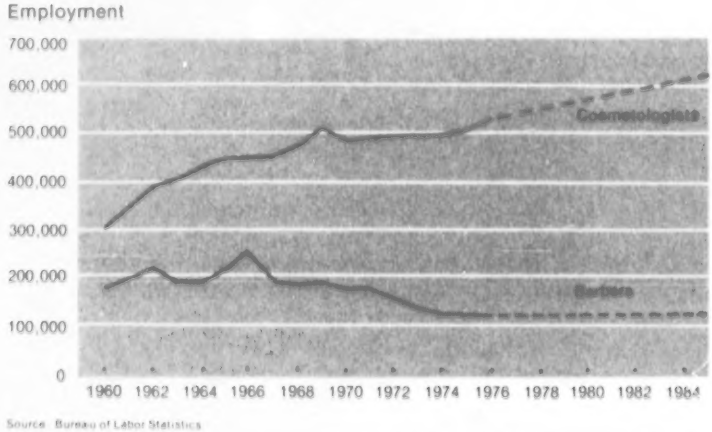
Most cosmetologists make appointments and keep records of hair color formulas and permanent waves used by their regular patrons. They also keep their work area clean and sanitize their hairdressing implements. Those who operate their own salons also have managerial duties which include hiring and supervising workers, keeping records, and ordering supplies.

Places of Employment

Most of the more than 534,000 cosmetologists employed in 1976 worked in beauty salons. Some worked in "unisex" shops, barber-styling shops, or department stores, and a few were employed by hospitals and hotels. More than one-third operated their own businesses.

All cities and towns have beauty salons, but employment is concentrated in the most populous cities and States. Those cosmetologists who set fashion trends with their hairstyles usually work in New York City, Los Angeles, and other centers of fashion and the performing arts.

Changing hairstyles have caused a drop in employment of barbers, but cosmetology has continued to grow



Source: Bureau of Labor Statistics

Training, Other Qualifications, and Advancement

Although all States require cosmetologists to be licensed, the qualifications necessary to obtain a license vary. Generally, a person must have graduated from a State-approved cosmetology school, have completed at least the 10th grade, pass a physical examination, and be at least 16 years old. In some States completion of an apprenticeship training program can substitute for graduation from a cosmetology school, but very few cosmetologists learn their skills in this way.

Cosmetology instruction is offered in both public and private vocational schools, in either daytime or evening classes. A daytime course usually takes 9 months to 1 year to complete; an evening course takes longer. Many public school programs include the academic subjects needed for a high school diploma and last 2 to 3 years. An apprenticeship program usually lasts 1 or 2 years.

Both public and private programs include classroom study, demonstrations, and practical work. Most schools provide students with the necessary hairdressing implements, such as manicure implements, combs, scissors, razors, and hair rollers, and include their cost in the tuition fee. Sometimes students must purchase their own. A good set of implements costs over $50. Beginning students work on manikins or on each other. Once they have gained some experience, students practice on patrons in school "clinics."

After graduating from a cosmetology course, students take the State licensing examination. The examination consists of a written test and a practical test in which applicants demonstrate their ability to provide the required services. In some States an oral examination is included and the applicant is asked to explain the procedures he or she is following while taking the practical test. In some States a separate examination is given for persons who want only a manicurist's license. Some States have reciprocity agreements that allow a cosmetologist licensed in one State to work in another without reexamination.

Cosmetologists must keep up with the latest fashions.

Persons who want to become cosmetologists must have finger dexterity, a sense of form and artistry, and the physical stamina to stand for long periods of time. They should enjoy dealing with the public and be willing and able to follow patrons' instructions. Because hairstyles are constantly changing, cosmetologists must keep abreast of the latest fashions and beauty techniques. Business skills are important for those who plan to operate their own salons.

Many schools help their students find jobs. During their first months on the job, new cosmetologists are given relatively simple tasks, such as giving manicures or shampoos, or are assigned to perform the simpler hairstyling patterns. Once they have demonstrated their skills, they are gradually permitted to perform the more complicated styling tasks such as hair coloring and permanent waving.

Advancement usually is in the form of higher earnings as cosmetologists gain experience and build a steady clientele; but many manage large salons or open their own after several years of experience. Some teach in cosmetology schools or use their knowledge and skill to demonstrate cosmetics in department stores. A few work as examiners for State cosmetology boards.

Employment Outlook

Employment of cosmetologists is expected to grow about as fast as the average for all occupations through the mid-1980's as population increases and the number of working women rises. The trend to hairstyling for men also creates a demand for these workers because many men go to unisex shops or beauty salons for styling services. In addition to openings due to growth in the occupation, thousands of cosmetologists will be needed each year to replace those who die, retire, or leave the occupation.

Employment in this occupation is not strongly affected by downturns in the business cycle, and job opportunities are expected to be good for both newcomers and experienced cosmetologists. Many openings should be available for persons seeking part-time work.

Earnings and Working Conditions

Cosmetologists receive income from commissions or wages and from tips. Those who are not salon owners receive a percentage of the money they take in, usually 50 percent; a few are paid straight salaries.

Weekly earnings of experienced cosmetologists (including tips) generally ranged between $285 and $340 in 1976, according to limited information available. After 10 years of experience, they can earn more than $450 a week. Beginners usually earned $95 to $125 a week. Those cosmetologists who cut and style men's hair often earn more than those who work on women's hair because the services they provide are more expensive.

Earnings also depend on the size and location of the salon, patrons' tipping habits, competition from other beauty salons, and the individual cosmetologist's ability to attract and hold regular patrons.

Many full-time cosmetologists work more than 40 hours a week, including evenings and Saturdays when beauty salons are busiest. More than one-third of all cosmetologists

work part time, usually during these busy hours.

A few large salons and department stores offer group life and health insurance and other benefit plans. Nearly all employers provide annual paid vacations of at least 1 week after a year's service.

The principal union which organizes cosmetologists—both employees and salon owners—is the Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietor's International Union of America. The principal trade association which represents and organizes salon owners, managers, and employees is the Associated Master Barbers and Beauticians of America. Other organizations include the National Hairdressers and Cosmetologists Association, Inc.; the National Association of Cosmetology Schools, Inc., which represents school owners and teachers; and the National Beauty Culturists' League, representing black cosmetologists, teachers, managers, and salon owners.

Sources of Additional Information

A list of approved training schools and licensing requirements can be obtained from State boards of cosmetology or from:

Cosmetology Accrediting Commission, 1707 L Street, N.W., Room 440, Washington, D.C. 20036

Additional information about careers in cosmetology and State licensing requirements is available from:

National Beauty Career Center, 3839 White Plains Rd., Bronx, N.Y. 19467.

National Hairdressers and Cosmetologists Association, 3510 Olive St., St. Louis, Mo. 63103.

For general information about the occupation, contact:

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors International Union of America, 7050 West Washington St., Indianapolis, Ind. 46241.

National Association of Cosmetology Schools, 599 South Livingston Ave., Livingston, N.J. 07039.

FUNERAL DIRECTORS AND EMBALMERS

(D.O.T. 187.168 and 338.381)

Nature of the Work

Few occupations require the tact, discretion, and compassion called for in the work of funeral directors and embalmers. The family and friends of the deceased may be under considerable emotional stress and bewildered by the many details of the occasion. The *funeral director* (D.O.T. 187.168) helps them to make the personal and business arrangements necessary for the service and burial. The *embalmer* (D.O.T. 338.381) prepares the body for viewing and burial. In many instances, one person performs both functions.

The director's duties begin when a call is received from a family requesting services. After arranging for the deceased to be removed to the funeral home, the director obtains the information needed for the death certificate, such as date and place of birth and cause of death. The director makes an appointment with the family to discuss the details of the funeral. These include time and place of service, clergy and organist, selection of casket and clothing, and provision for burial or cremation. Directors also make arrangements with the cemetery, place obituary notices in newspapers, and take care of other details as necessary. Directors must be familiar with the funeral and burial customs of various religious faiths and fraternal organizations.

Embalming is a sanitary, preservative and cosmetic measure. Embalmers, perhaps with the help of apprentices, first wash the body with germicidal soap. The embalming process itself replaces the blood with a preservative fluid. Embalmers apply cosmetics to give the body a natural appearance and, if necessary, restore disfigured features. Finally, they dress the body and place it in the casket selected by the family.

On the day of the funeral, directors provide cars for the family and pallbearers, receive and usher guests to their seats, and organize the funeral procession. After the service they may help the family file claims for social security, insurance, and other benefits. Directors may serve a family for several months following the funeral until such matters are satisfactorily completed.

Places of Employment

About 45,000 persons were licensed as funeral directors and embalmers in 1976. A substantial number of the directors were funeral home owners.

Most of the 22,000 funeral homes in 1976 had 1 to 3 directors and embalmers, including the owner. Many large homes, however, had 20 or more. Besides the embalmers employed by funeral homes, several hundred worked for morgues and hospitals.

Training, Other Qualifications, and Advancement

A license is needed to practice embalming. State licensing standards vary but generally an embalmer must be 21 years old, have a high school diploma or its equivalent, graduate from a mortuary science school, serve an apprenticeship, and pass a State board examination. One-half of the States require a year or more of college in addition to training in mortuary science.

All but six States also require funeral directors to be licensed. Qualifications are similar to those for embalmers but directors may have to take special apprenticeship training and board examinations. Most people entering the field obtain both licenses, however some States issue a single license to embalmer/funeral directors. Information on licensing requirements is available from the State office of occupational licensing.

High school students can start preparing for a career in this field by taking courses in biology, chemistry, and speech. Students may find a part-time or summer job in a funeral home. Although these jobs consist mostly of maintenance and clean-up tasks, such as washing and polishing hearses, they can be helpful in gain-

ing familiarity with the operation of funeral homes.

In 1976, 34 schools had mortuary science programs accredited by the American Board of Funeral Service Education. About one-half were private vocational schools that offer 1-year programs emphasizing basic subjects such as anatomy and physiology as well as practical skills such as embalming techniques and restorative art. Community colleges offer 2-year programs, and a small number of colleges and universities offer 2- and 4-year programs in funeral service. These programs included liberal arts and management courses as well as mortuary science. All programs offered courses in psychology, accounting, and funeral law.

Apprentices work under the guidance of experienced embalmers and directors. An apprenticeship usually lasts 1 or 2 years and may be served before, after, or during the time one attends mortuary school, depending on State regulations.

State board examinations consist of written and oral tests and actual demonstration of skills. After passing the examination and meeting other requirements, apprentices receive a license to practice. If they want to work in another State, they may have to pass its examination, although many States have mutual agreements that make this unnecessary.

Important personal traits for funeral directors are composure, tact, and the ability to communicate easily with the public. They also should have the desire and ability to comfort people in their time of sorrow.

Advancement opportunities are best in large funeral homes where directors and embalmers may earn promotion to higher paying positions such as personnel manager or general manager. Some workers eventually acquire enough money and experience to establish their own businesses.

Employment Outlook

Little change in the employment of funeral directors and embalmers is expected through the mid-1980's. In recent years, the number of mortuary school graduates has approximately equaled the number of jobs available due to retirements, deaths, and transfers to other occupations. Many students secure a promise of employment before entering a program and, barring any significant growth in enrollments, future graduates should find job opportunities available.

Demand for funeral services will rise as the population grows and deaths increase. Most funeral homes, however, will be able to meet the demand without expanding their employment. The average funeral home conducts only one or two funerals each week and is capable of handling several more without hiring additional employees.

Earnings and Working Conditions

In 1976, funeral directors and embalmers generally earned from $200 to $300 a week. Managers generally earned between $10,000 and $16,000 a year, and many owners earned more than $20,000. Apprentices earned between $2.25 and $4.60 an hour.

In large funeral homes, employees usually have a regular work schedule. Typically they put in 8 hours a day, 5 or 6 days a week. Overtime, however, occasionally may be necessary. Some employees work shifts; for example, nights 1 week, and days the next.

Occasionally embalmers may come into contact with contagious diseases but the possibility of their becoming ill is remote, even less likely than for a doctor or nurse.

Sources of Additional Information

Information about job opportunities in this field is available from local funeral homes and from:

National Funeral Directors Association of the United States, Inc., 135 W. Wells St., Milwaukee, Wisc. 53203.

National Selected Morticians, 1616 Central St., Evanston, Ill. 60201.

For a list of accredited schools of mortuary science and information about scholarship opportunities, contact:

The American Board of Funeral Service Education, Inc., 201 Columbia St., Fairmont, W. Va. 26554.

PRIVATE HOUSEHOLD SERVICE OCCUPATIONS

About 1.4 million workers were employed in private households in 1976. The majority were domestic workers who performed household tasks such as cooking, cleaning, or caring for children, but workers in other occupations also were employed by private households. Gardeners keep the grounds of large estates looking attractive by planting shrubs and flowers and cutting the lawn. Chauffeurs drive their employers' cars and keep the vehicles clean and in good running condition. Carpenters, painters, and other craft workers maintain and redecorate homes. Private nurses, secretaries, and curators or librarians are employed in some households.

The following statement discusses the domestic occupations most frequently found in private households, including general housekeeper, mother's helper, and companion.

PRIVATE HOUSEHOLD WORKERS

(D.O.T. 099.228, 301.887, 303.138, 304.887, 305.281, 306.878, 307.878, and 309.138 through .878)

Nature of the Work

Thousands of people employ private household workers to help care for children, clean and maintain the house and yard, cook meals, or serve the family. Some household workers specialize in one of these jobs, but the duties of most workers change from day to day. Frequently, workers who specialize live in their employer's house.

Most private household workers are employed as *general houseworkers* or *mother's helpers*. These workers clean the house and may also be responsible for meal preparation, laundry, or caring for children. When hired by the day or hour, they are called *day workers*.

Heavy household tasks and yard maintenance are usually performed by *caretakers*. They may wash windows, paint fences and mow the lawn.

In some households, meals are prepared by *cooks*. Some cooks do everything from planning menus and buying food to serving meals and cleaning the kitchen. Others follow the instructions of a family member. Cooks may be assisted by a *cook's helper*, who is less skilled than a cook and performs simple tasks, such as peeling vegetables and cleaning the kitchen.

A few households employ *launderers* to wash, iron, and fold the laundry.

Some private household workers specialize in performing personal services for members of the family. *Lady's and gentleman's attendants* keep their employer's clothes pressed and hung, make their beds, help them dress, and run errands. *Companions* do similar work, but they also act as a friend or aide to the convalescent, elderly, or handicapped person who employs them.

Some private households employ workers whose sole job is child care.

Most private household workers are employed as general houseworkers or mothers' helpers.

Unlike mothers' helpers, whose duties generally entail light housekeeping as well as child care, these workers have no general housekeeping responsibilities. Such workers bathe the children, prepare their meals, launder their clothes, and supervise their play. Those who care for very young children are responsible for sterilizing bottles, preparing formulas, and changing diapers. Some households employ tutors, who usually are in charge of school-age children and supervise their recreation, diet, and health, as well as their education. These workers also are responsible for disciplining the children and arranging their activities.

A household with a large staff of workers may employ a *home housekeeper* or a *butler* to supervise the staff and the operation of the household. These workers usually are responsible for hiring and firing the other household employees. In addition to these duties, butlers receive and announce guests, answer telephones, serve food and drinks, and may act as gentleman's attendants. Housekeepers order food and cleaning supplies and keep a record of expenditures.

Places of Employment

Nearly 1.1 million persons were employed as private household workers in 1976. Most are employed part time, working half-days or only 2 or 3 days a week. Those who live in their employer's house work longer hours.

Training, Other Qualifications, and Advancement

For most household jobs, experience and an ability to cook, clean, or care for a yard is important; formal education is not. Employers prefer workers who know how to operate vacuum cleaners, floor waxers, and lawn mowers, but most young people can learn these skills while helping with the house and yard work at home. Some household workers acquire skills by spending a year working as a mother's helper under the supervision of either an experienced household worker or their employer.

Home economics courses in high schools, vocational schools, and junior colleges offer training in child development and meal preparation that can be very useful to persons interested in becoming cooks or child care workers. Training programs sponsored by Federal agencies, State employment service offices, and local welfare departments also teach many of the skills needed for household work.

For a person wishing a job serving as a companion or caring for children, educational and cultural background is more important than work experience. Generally a companion's background, interests, and age should be similar to the employer's, and practical nursing experience is useful if the employer is an invalid. Being able to read well or carry on an interesting conversation is helpful. A well-rounded education and teaching skills are important for persons interested in caring for children.

Private household workers must have physical stamina because they are on their feet most of the time and sometimes must do some heavy lifting. The desire to do a job carefully and thoroughly is important. Household workers should be able both to get along well with people and to work independently. Some workers, particularly cooks and infant's nurses, need a health certificate showing that they are free of contagious diseases. Many employers arrange and pay for the necessary physical examination.

Advancement other than an increase in wages generally is not possible in private household work. Few households require live-in workers, and even fewer require so many workers that a butler or home housekeeper is needed as a supervisor. Workers can transfer to better paying and more highly skilled household jobs, such as cook or lady's or gentleman's attendant, but job openings in these occupations are limited.

However, many private household workers use their training and experience to transfer to related jobs—in child care or day care facilities, or as kitchen workers in restaurants. Some may go to work as building cleaners, employed by commerical cleaning services. Others may go to work as nursing aides in hospitals, or nursing homes, or homemaker-home health aides employed by health agencies, public welfare departments, or commerical firms.

Employment Outlook

Although the number of private household workers is expected to decline through the mid-1980's, thousands of openings will result each year from the need to replace those who die, retire, or leave the occupation. The demand for household workers has exceeded supply for some time, as more women, especially those with young children, enter the labor force. Low wages, the tedious nature of some household tasks, and the lack of advancement opportunities discourage many persons from entering the occupation, however, and some prospective employers are turning to child-care centers and commercial cleaning services for help.

Job openings for domestic workers, particularly for general housekeepers and mothers' helpers, will be plentiful through the mid-1980's. Many openings will be available for part-time work.

Earnings and Working Conditions

In 1975, full-time female private household workers averaged $2,413 a year, less than half the average for all nonsupervisory workers in private industry, except farming. Earnings data are not available for men in the occupation because men represent such a small proportion of total employment. The provisions of Federal and State minimum wage laws were extended to private household workers in May 1974.

Wages vary according to the work performed, employer's income, and the custom of the local area. Earnings are highest in large cities, especially in the North.

Most private household workers receive instructions from their employers, but are free to work on their own. Frequently, they have a key to the house or apartment. Household work is often tedious, especially for day workers who generally are given

the less desirable tasks, such as cleaning bathrooms or defrosting the refrigerator. Long or irregular working hours can isolate workers who "live in" from their families and friends, and if they are the sole employees in the households, they are likely to be alone most of the time.

Sources of Additional Information

Facts about employment opportunities and training programs in private household work are available from local offices of State employment agencies.

Information on laws affecting household workers and guidelines for work is available from:

National Committee on Household Employment, 7705 Georgia Ave. NW., Suite 208, Washington, D.C. 20012.

PROTECTIVE AND RELATED SERVICE OCCUPATIONS

The growth of our Nation's population and economy has put an increasing emphasis on protective services. Each city, suburban area, and national port of entry requires protective and related service workers to check crime, minimize loss of life and property, and enforce regulations that protect the health and safety of our citizens at home and on the job.

Careers in protective and related service occupations require varied combinations of education and experience. Workers such as FBI special agents and some Federal Government inspectors must have at least a bachelor's degree, while guards may have less than a high school education. Most occupations in this group, however, require a high school diploma. In many cases, a college degree is an asset for advancement to higher level positions.

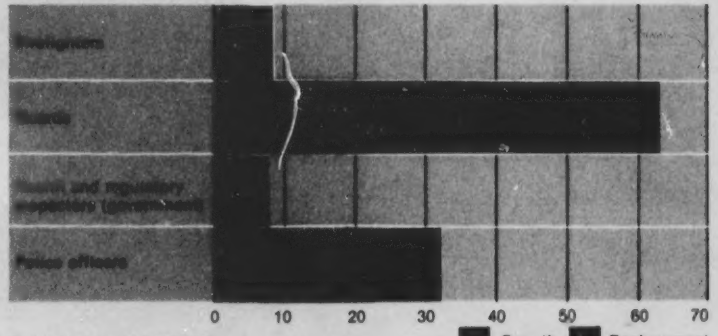
In addition to educational requirements, most workers in protective and related services must undergo formal training programs and get on-the-job experience before they are fully qualified. Training programs last from several days to a few months and emphasize specific job-related skills.

Personal qualifications such as honesty and an understanding of human nature are important. Persons seeking careers in protective and related service occupations should sincerely desire to serve the community and be able to exercise proper judgment under a variety of conditions.

This section describes the work of several occupations in protective and related services: correction officers, FBI special agents, firefighters, guards, police officers, State police officers, occupational safety and health workers, and health, regulatory, and construction inspectors.

Except for guards, most openings in the protective service occupations result from growth in employment needs

Selected protective and related service occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

CORRECTION OFFICERS

(D.O.T. 372.868 and 375.168 and .868)

Nature of the Work

Correction officers are charged with the safekeeping of persons who have been arrested, are awaiting trial, or who have been tried and convicted of a crime and sentenced to serve time in a correctional institution. They maintain order within the institution, enforce rules and regulations, and often counsel inmates.

To make sure inmates are orderly and obey rules, correction officers keep a close watch on everything the immates do—working, exercising, eating, and bathing. They give and oversee work assignments for inmates, as well as instruct and help them on specific tasks. Sometimes it is necessary to search inmates for forbidden items, such as weapons or drugs, to settle disputes between inmates, and to enforce discipline. They cannot show favoritism to any inmate and must report all who violate rules. To prevent escapes, officers serve as guards on towers and at gates. They count inmates to make sure all are present during transfers and activities.

Correction officers examine facilities to assure the safety and security of prisoners. They check cells and other areas of the institution for unsanitary conditions, fire hazards, and evidence of infraction of rules by inmates. Periodically, they inspect locks, windowbars, grill doors, and gates for tampering.

Correction officers report orally and in writing on inmate conduct and on the quality and quantity of work done by inmates. Officers also report disturbances, violations of rules, and any unusual occurrences. They keep a record of their activities in a notebook.

Correction officers escort inmates to and from cells and other areas and admit and accompany authorized visitors within the facility. From time to time, they may censor mail, administer first aid, or assist police authorities by investigating crimes committed within the institution and by searching for escaped inmates.

Correction officers oversee work assignments of inmates and instruct them in specific tasks.

Counseling inmates and helping them with problems also is an important part of the correction officer's job. Officers play a key role in efforts to rehabilitate inmates by helping them adjust to life in the institution, preparing them for later civilian life, and counseling them on how to avoid future criminal behavior. In some institutions, officers lead or participate in group counseling sessions. More often, however, the counseling is informal. Officers may arrange a change in a daily schedule so that an inmate has an opportunity to visit the library, help inmates get news of their families, talk over personal problems that may have led to committing a crime, or suggest where to look for a job after release from prison.

Correction sergeants directly supervise correction officers. They usually are responsible for maintaining security and directing the activities of a group of inmates during an assigned watch.

Places of Employment

There were about 90,000 correction officers in 1976. More than 9 out of 10 correction officers work for State and local governments; the remainder work for the Federal Government.

Most correction officers work in relatively large institutions located outside metropolitan areas, although a significant number work in smaller facilities located in towns.

Training, Other Qualifications, and Advancement

The Federal Government, as well as almost every State and a few localities, provides training for correction officers. Some States—Maryland and New York are two—have special training academies. Most States, however, provide informal on-the-job training.

Academy trainees generally receive 4 to 8 weeks of instruction on institutional policies, regulations and procedures, the behavior and custody of inmates, writing reports, and security. On-the-job trainees receive 2 to 6 months of similar training in an actual job setting under the guidance of an experienced officer. Experienced officers sometimes receive in-service training to keep abreast of new ideas and procedures.

Most penal systems require that correction officers be at least 21 years old and have a high school education or its equivalent, or else work experience that qualifies them. They must be in good health. Many States require candidates to meet formal standards of height, weight, vision, and hearing. Strength, good judgment, and the ability to think and act quickly are assets. Some States require candidates to have 1 or 2 years' experience in corrections or related police work. A few States require candidates to pass a written examination.

With additional education, experience, and training, qualified officers may advance to correction sergeant or other supervisory or administrative positions. Officers sometimes transfer to related areas, such as probation and parole.

Employment Outlook

Employment of correction officers is expected to increase about as fast as the average for all occupations through the mid-1980's. The likely population increase within correctional facilities is expected to create

growth in the employment of correction officers. Many additional openings will result from job turnover and the need to replace workers who die or retire.

Earnings and Working Conditions

In 1976, salaries for correction officers varied widely by level of government. At the Federal level, the starting salary was $10,370 per year; the average salary for all Federal correction officers and correction sergeants was $12,675 per year. At the State level, starting salaries averaged $8,900 per year while maximum salaries averaged $11,400 per year. Salaries of correction sergeants range from an average minimum of $10,259 to an average maximum of $13,426 at the State level.

Correction officers usually work an 8-hour day, 40-hour week. Prison security must be provided around the clock, which means some officers work weekends, holidays, and nights. During emergencies, officers may work overtime, for which they are paid straight time, or time-and-one-half, or are given equal time off.

Officers may work either indoors with inmates or outdoors on towers or at gates. Although corrections work is not normally hazardous, there is always the threat of trouble by inmates.

Sources of Additional Information

Information about entrance requirements, training, and career opportunities for correction officers may be obtained from Federal and State civil service commissions, State departments of corrections, or nearby correctional institutions and facilities.

Additional information describing a career as a correction officer is available from:

American Correctional Association, National Offender's Services Contact Center, P.O. Box 81826, Lincoln, Neb. 68501.

FBI SPECIAL AGENTS

(D.O.T. 375.168)

Nature of the Work

Federal Bureau of Investigation (FBI) special agents investigate violations of Federal laws in connection with bank robberies, kidnappings, white-collar crime, thefts of Government property, organized crime, espionage, and sabotage. The FBI, which is part of the U.S. Department of Justice, has jurisdiction over many different Federal investigative matters. Special agents, therefore, may be assigned to any type of case, although those with specialized training usually work on cases related to their background. Agents with an accounting background, for example, may investigate white-collar crimes such as bank embezzlements, or fraudulent bankruptcies or land deals.

Because the FBI is a fact-gathering agency, its special agents function strictly as investigators, collecting evidence in cases in which the U.S. Government is or may be an interested party. In their casework, special agents conduct interviews, examine records, observe the activities of suspects, and participate in raids. Because the FBI's work is highly confidential, special agents may not disclose any of the information gathered in the course of their official duties to unauthorized persons, including members of their families. Frequently agents must testify in court about cases that they investigate.

Although they work alone on most assignments, agents communicate with their supervisors by radio or telephone as the circumstances dictate. In performing potentially dangerous duties, such as arrests and raids, two agents or more are assigned to work together.

Places of Employment

About 8,600 persons were special agents in 1976. Most agents were assigned to the FBI's 59 field offices located throughout the Nation and in Puerto Rico. They worked in cities where field office headquarters are located or in resident agencies (suboffices) established under field office supervision to provide prompt and efficient handling of investigative matters arising throughout the field office territory. Some agents are assigned to the Bureau headquarters in Washington, D.C., which supervises all FBI activities.

Special agents process a car for fingerprints.

Training, Other Qualifications, and Advancement

To be considered for appointment as an FBI special agent, an applicant usually must be a graduate of a State-accredited law school or a college graduate with a major in accounting. The law school training must have been preceded by at least 2 years of undergraduate college work.

From time to time, as the need arises, the FBI accepts applications from persons who have a 4-year college degree with a physical science major or fluency in a foreign language, or who have 3 years of professional, executive, complex investigative, or other specialized experience.

Applicants for the position of FBI special agent must be citizens of the United States, be at least 23 years old but not have reached their 35th birthday before they begin duty and be willing to serve anywhere in the United States or Puerto Rico. They must be capable of strenuous physical exertion, and have excellent hearing and vision, normal color perception, and no physical defects that would prevent their using firearms or participating in dangerous assignments. All applicants must pass a rigid physical examination, as well as written and oral examinations testing their aptitude for meeting the public and conducting investigations. All of the tests except the physical examinations are given by the FBI at its facilities. Background and character investigations are made of all applicants. Appointments are made on a probationary basis and become permanent after 1 year of satisfactory service.

Each newly appointed special agent is given about 15 weeks of training at the FBI Academy at the U.S. Marine Corps Base in Quantico, Va. before assignment to a field office. During this period, agents receive intensive training in defensive tactics and the use of firearms. In addition, they are thoroughly schooled in Federal criminal law and procedures, FBI rules and regulations, fingerprinting, and investig a tive work. After assignment to a field office, the new agent usually works closely with an experienced agent for about 2 weeks before handling any assignments independently.

All administrative and supervisory jobs are filled from within the ranks by selecting those FBI special agents who have demonstrated the ability to assume more responsibility.

Employment Outlook

The jurisdiction of the FBI has expanded greatly over the years. Although it is impossible to forecast special agent personnel requirements, employment may be expected to increase with growing FBI responsibilities.

The FBI provides a career service and its rate of turnover is traditionally low. Nevertheless, the FBI is always interested in applications from qualified persons who would like to be considered for the position of special agent.

Earnings and Working Conditions

The entrance salary for FBI special agents was $15,524 in late 1976. Special agents are not appointed under Federal Civil Service regulations, but, like other Federal employees, they receive periodic within-grade salary raises if their work performance is satisfactory; they can advance in grade as they gain experience. Salaries of supervisory agents start at $28,725 a year.

Special agents are subject to call 24 hours a day and must be available for assignment at all times. Their duties call for some travel, for they are assigned wherever they are needed in the United States or Puerto Rico. They frequently work longer than the customary 40-hour week and, under specified conditions, receive overtime pay up to about $3,900 a year. They are granted paid vacations, sick leave, and annuities on retirement. Agents are required to retire at age 55 if they have served at least 20 years.

Sources of Additional Information

The Federal Bureau of Investigation, U.S. Department of Justice, Washington, D.C. 20535.

FIREFIGHTERS

(D.O.T. 373.118 through .884)

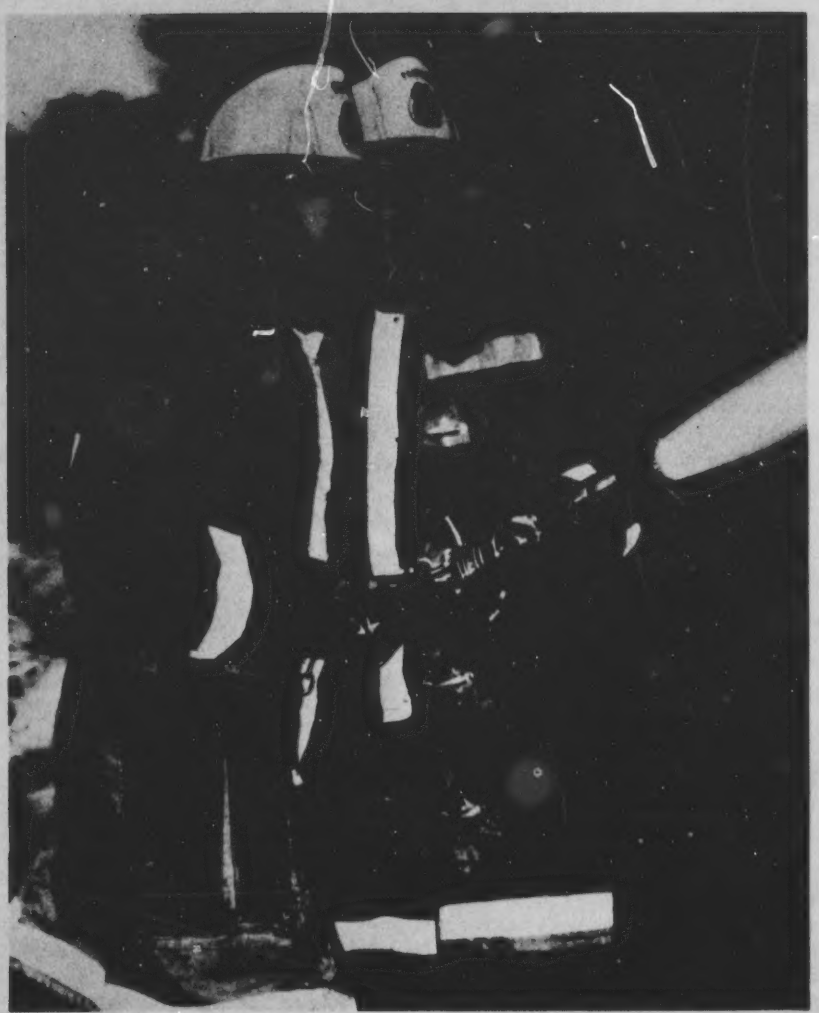
Nature of the Work

Every year fires destroy thousands of lives and property worth millions of dollars. Firefighters help protect the public against this danger. This statement gives information only about paid (professional) firefighters; it does not cover the many thousands of volunteer firefighters in communities across the country.

During duty hours, firefighters must be prepared to respond to a fire and handle any emergency that arises. Because firefighting is dangerous and complicated, it requires organization and teamwork. At every fire, firefighters perform specific duties assigned by a company officer such as lieutenant, captain, or other department officer: they may connect hose lines to hydrants, operate a pump, or position ladders. Because their duties may change several times while the company is in action they must be skilled in many different firefighting activities such as rescue, ventilation, and salvage. Some firefighters operate fire apparatus, emergency rescue vehicles, and fire boats. In addition, they help people to safety and administer first aid.

Most fire departments also are responsible for fire prevention activities. They provide specially trained personnel to inspect public buildings for conditions that might cause a fire. They may check building plans, the number and working condition of fire escapes and fire doors, the storage of flammable materials, and other possible hazards. In addition, firefighters educate the public about fire prevention and safety measures. They frequently speak on this subject before school assemblies and civic groups, and, in some communities, they inspect private homes for fire hazards.

Between alarms, firefighters spend much time improving their skills and doing maintenance work. They also have practice drills, clean and lubricate equipment, and stretch hoses to dry.



Firefighting requires organization and teamwork.

Places of Employment

More than 210,000 persons worked as firefighters in 1976. Nine out of ten worked in municipal fire departments. Some very large cities have several thousand firefighters on the payroll while many small towns have fewer than 25. Some firefighters work in fire departments on Federal installations; others work in large manufacturing plants.

Training, Other Qualifications, and Advancement

Applicants for municipal firefighting jobs must pass a written test, a medical examination, and tests of strength, physical stamina, and agility, as specified by local regulations. These examinations are open to men and women who are at least 18 years of age, meet certain height and weight requirements, and have a high school education or equivalent. Those who receive the highest scores on the examinations have the best chances for appointment. Extra credit usually is given for military service. Experience gained as a volunteer firefighter or through training in the Armed Forces also may improve an applicant's chances for appointment.

As a rule, beginners in large fire departments are trained for several weeks at the city's fire school. Through classroom instruction and practice drills, the recruits study firefighting techniques, fire prevention, local building codes, and first aid; also, they learn how to use axes, chemical extinguishers, ladders, and other equipment. After completing this training, they are assigned to a fire company where they are evaluated during a probationary period.

Experienced firefighters often continue study to improve their job performance and prepare for promotional examinations. Fire departments frequently conduct training programs, and many colleges and universities offer courses such as fire engineering and fire science that are helpful to firefighters.

Among the personal qualities firefighters need are mental alertness, courage, mechanical aptitude, endurance, and a sense of public service. Initiative and good judgment are extremely important because firefighters often must make quick decisions in emergency situations. Because members of a crew eat, sleep, and work closely together under conditions of stress and danger, they should be dependable and able to get along well with others in a group. Leadership qualities are assets for officers who must establish and maintain a high degree of discipline and efficiency as well as direct the activities of the firefighters in their companies.

Opportunities for promotion are good in most fire departments. As firefighters gain experience, they may advance to a higher rank. After 3 to 5 years of service they may become eligible for promotion to the grade of lieutenant. The line of further promotion usually is to captain, then battalion chief, assistant chief, deputy chief, and finally to chief. Chances for advancement generally depend upon each candidate's position on the promotion list, as determined by the score on a written examination, his or her supervisor's rating, and seniority.

Employment Outlook

Employment of firefighters is expected to increase about as fast as the average for all occupations through the mid-1980's to meet the growing need for fire protection. Thousands of jobs will become available each year due to growth and the

need to replace those who die, retire, or leave the occupation.

Employment should rise as new fire departments are formed and as others enlarge their fire prevention sections. Much of the expected increase will occur in smaller communities as volunteer firefighters are replaced by professionals. Additional firefighters also may be required as more cities shorten the workweek for firefighters.

The number of firefighters in a community ultimately depends upon the availability of funds from the municipal government for salaries and equipment. Fire protection is an essential service and citizens are likely to exert considerable pressure on city officials to expand fire protection coverage. However, local governments must live within their budgets. This means that in some financially troubled cities, firefighter employment probably will remain at current levels or decline while in other cities, employment is likely to increase substantially to meet the needs of an expanding population.

The number of people who qualify for firefighter jobs in large cities usually is greater than the number of job openings, even though the written examination and physical requirements eliminate many applicants. Therefore, competition among candidates in urban areas is apt to remain keen. Opportunities should be much better in smaller communities.

Earnings and Working Conditions

In 1976, average entrance salaries for beginning full-time firefighters ranged from $9,900 to $12,200 a year, depending on city size and region of the country. Average maximum salaries varied from $12,600 to $14,850 annually. Earnings for firefighters are lowest in the South and highest in the West, and generally are higher in suburban districts than in large cities. Average earnings of all firefighters are about one and one-half times as much as the average of all nonsupervisory workers in private industry, except farming.

Fire lieutenants started at an average salary of $13,700 a year in 1976 and earned an average maximum salary of $16,100. Fire captains started at an average salary of $15,450 a year and earned an average maximum of $18,300.

Practically all fire departments furnish allowances to pay for protective clothing (helmets, boots, and rubber coats) and many also provide dress uniforms.

In some cities, firefighters are on duty for 24 hours, then off for 48 hours, and receive an extra day off at intervals. In other cities, they work a day shift of 10 hours and a night shift of 14; shifts are rotated at frequent intervals. The average workweek for firefighters is 52 hours, but is only 42 hours in many large cities, particularly in the East. Some firefighters work as many as 84 hours a week. Fire lieutenants and fire captains work the same hours as the firefighters they supervise. Duty hours may include some time when firefighters are free to read, study, or pursue other personal interests. In addition to scheduled hours, firefighters often must work extra hours when they are bringing a fire under control. When overtime is worked, most fire departments give compensatory time off or extra pay.

The job of a firefighter involves risk of death or injury from sudden cave-ins of floors or toppling walls and danger from exposure to flames and smoke. Firefighters also may come in contact with poisonous, flammable, and explosive gases and chemicals. In addition, they work in all types of weather.

Firefighters generally are covered by liberal pension plans that often provide retirement at half pay at age 50 after 25 years of service or at any age if disabled in the line of duty. Firefighters also receive paid vacations. Provisions for sick leave usually are liberal. Health and surgical benefit plans are offered in many fire departments and compensation is provided for firefighters injured in the line of duty. Most fire departments provide paid holidays—ranging to 11 or more a year—or compensatory time off for working on holidays.

About 8 out of 10 firefighters are members of the International Association of Firefighters (AFL-CIO).

Sources of Additional Information

Information on obtaining a job as a firefighter is available from local civil service commission offices or fire departments.

Information about a career as a firefighter may be obtained from:

International Association of Fire Chiefs, 1725 K St. NW., Washington, D.C. 10006.

National Fire Protection Association, 470 Atlantic Ave., Boston, Mass. 02210.

Additional information on the salaries and hours of work of firefighters in various cities is published annually by the International City Management Association in its *Municipal Yearbook*, which is available in many libraries.

GUARDS

(D.O.T. 372.868)

Nature of the Work

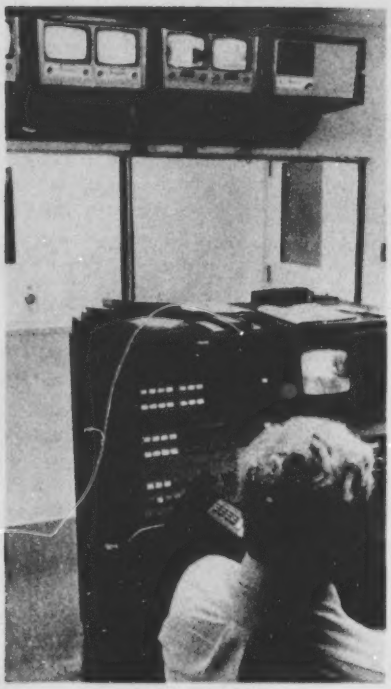
Guards patrol and inspect property to protect it against fire, theft, vandalism, and illegal entry. The specific duties of these workers, however, vary depending on the size, type, and location of their employer.

In office buildings, banks, hospitals, and department stores, guards protect records, merchandise, money, and equipment. In department stores they often work with undercover detectives watching for theft by customers or store employees.

At ports and railroads, guards protect merchandise in shipment as well as property and equipment. They insure that nothing is stolen while being loaded or unloaded, and watch for fires, prowlers, and trouble among work crews. Sometimes they direct traffic.

Guards who work in public buildings, such as museums or art galleries, protect paintings or exhibits from fire, theft, or damage. They also answer routine questions from visitors and sometimes guide traffic.

In large factories, aircraft plants, and defense installations where valuable information must be protected, some guards check the credentials of persons and vehicles entering and



Bank guards maintain the security of the bank by monitoring closed circuit television cameras.

leaving the premises. University, park, or recreation guards perform similar duties and also may issue parking permits and direct traffic.

At social affairs, sports events, conventions, and other public gatherings, guards maintain order, give information, and watch for persons who may cause trouble.

In a large organization, a security officer often is in charge of the guard force; in a small organization, a single worker may be responsible for security. Patrolling usually is done on foot; but if the property is large, guards may make their rounds by car or motor scooter.

As they make their rounds, guards check all doors and windows, see that no unauthorized persons remain after working hours, and insure that fire extinguishers, alarms, sprinkler systems, furnaces, and various electrical and plumbing systems are working properly. They sometimes set thermostats or turn on machines for janitorial workers.

Guards usually are uniformed and often carry a nightstick or gun. They also may carry a flashlight, whistle, two-way radio, and a watch clock—a device that indicates the time at which they reach various checkpoints. (The related occupation of correction officer also is discussed in this section on protective service occupations.)

Places of Employment

In 1976, almost 500,000 persons worked as guards. Most work in office buildings, government installations and buildings, stores, hotels, banks, schools, and manufacturing plants. Industrial security firms and guard agencies employ about 40 percent of all guards; agency guards work under contract in private business establishments of all types, as well as in some government facilities.

Although guard jobs are found throughout the country, most are located in highly industrialized areas.

Training, Other Qualifications, and Advancement

Most employers prefer guards who are high school graduates. Applicants with less than a high school education usually are tested for their reading and writing abilities and their competence in following written and oral instructions. Employers also seek people who have had experience in the military police or in State and local police departments. Most persons who enter guard jobs have prior work experience, although it is usually unrelated. Many have retired from careers in the military or other protective services, and their guard employment is a second career.

Candidates for guard jobs in the Federal Government must be veterans, have some experience as guards, and pass a written examination. For most Federal guard positions, applicants must qualify in the use of firearms. A driver's permit is required for some jobs.

Many employers give newly hired guards instruction before they start the job and also provide several weeks of on-the-job training. Guards may be taught the use of firearms, the administration of first aid, the procedure to use in handling various emergencies, and ways to spot and deal with security problems.

Applicants are expected to have good character references, no police record, good health—especially in hearing and vision—and good personal habits such as neatness and dependabiluty.They should be mentally alert, emotionally stable, and physically fit to cope with emergencies. Some employers require guards to meet height and weight specifications or to be within a certain age range.

Although guards in small companies receive periodic salary increases, advancement is likely to be limited. However, most large organizations use a military type of ranking that offers advancement in position and salary. Guard experience enables some persons to transfer to police jobs that offer higher pay and greater opportunities for advancement. Gards with some college education may advance to jobs that involve administrative duties or the prevention of espionage and sabotage.

Employment Outlook

Employment of guards is expected to grow faster than the average for all occupations through the mid-1980's. Increased concern for crime and vandalism will heighten the need for security in and around plants, stores, and recreation areas and is expected to cause rapid growth of agency guard employment. Additional guards will be needed by banks, manufacturing plants, and Federal, State, and local governments to provide better security and monitor remote cameras, alarm systems, and other electronic surveillance equipment. Many openings also will arise as guards retire, die, or leave their jobs for other reasons. Opportunities will be most plentiful for persons seeking work on night shifts.

Earnings and Working Conditions

Wages of guards working in 36 urban areas were estimated to average $3.23 an hour in 1976. Those working in the North earned more than the average while guards employed in the South and West earned somewhat less. Hourly wages of guards were estimated to average $5.04 in manufacturing; $5.29 in transportation and public utilities; $4.10 in banking, finance, insurance, and real

estate; $4.22 in wholesale trade; $3.70 in retail trade; and $2.61 in the various service industries, including security and guard agencies. Guards who were members of unions earned more than average.

Depending on their experience, newly hired guards in the Federal Government earned between $142 and $160 a week. Top supervisory guards in the Federal Government may be paid up to $271 a week. These workers usually receive overtime pay as well as a wage differential for the second and third shifts. Guards generally have paid vacations, sick leave, and insurance and pension plans.

About two-thirds of all guards work at night; the usual shift lasts 8 hours. Some employers have three shifts where guards rotate to divide daytime, weekend, and holiday work equally. Guards usually eat on the job instead of taking a regular lunch break.

Guards often work alone, so that no one is nearby to help if an accident or injury occurs. Some large firms therefore use a reporting service that enables guards to be in constant contact with a central station outside the plant. If they fail to transmit an expected signal, the central station investigates.

Sources of Additional Information

Further information about work opportunities for guards is available from local employers and the nearest State employment service office.

POLICE OFFICERS

(D.O.T. 375.118 through .868, and 377.868)

Nature of the Work

The security of our Nation's cities and towns greatly depends on the work of local police officers whose jobs range from controlling traffic to preventing and investigating crimes. Whether on or off duty, these officers are expected to exercise their authority whenever necessary.

Police officers who work in a small community have many duties. In the course of a day's work, they may direct traffic at the scene of a fire, investigate a housebreaking, and give first aid to an accident victim. In a large police department, by contrast, officers usually are assigned to a specific type of duty. Most officers are detailed either to patrol or to traffic duty; smaller numbers are assigned to special work such as accident prevention or operation of communications systems. Others work as detectives (plainclothes officers) assigned to criminal investigation; still others, as experts in chemical and microscopic analysis, firearms identification, and handwriting and fingerprint identification. In very large cities, a few officers may work with special units such as mounted and motorcycle police, harbor patrols, helicopter patrols, canine corps, mobile rescue teams, and youth aid services.

Most new recruits begin on patrol duty. Recruits may be assigned to such varied areas as congested business districts or outlying residential areas. They may cover their beats alone or with other officers. They may ride in a police vehicle or walk on "foot" patrol. In any case, they become thoroughly familiar with conditions throughout their area and, while on patrol, remain alert for anything unusual. They note suspicious circumstances, such as open windows or lights in vacant buildings, as well as hazards to public safety such as burned-out street lights or fallen trees. Officers also watch for stolen automobiles and enforce traffic regulations. At regular intervals, they report to police headquarters through call boxes, by radio, or by walkie-talkie. They prepare reports about their activities and may be called on to testify in court when cases result in legal action.

Places of Employment

About 500,000 full-time officers worked for local police departments in 1976. Some cities have very large police forces. For example, New York has about 30,000 police officers and Chicago has nearly 13,000. Hundreds of small communities employ fewer than 25 officers each.

Training, Other Qualifications, and Advancement

Local civil service regulations govern the appointment of police officers in practically all large cities and in many small ones. Candidates must be U.S. citizens, usually at least 21

Police officers often work independently in carrying out their duties.

years of age, and must meet certain height and weight standards. Eligibility for appointment depends on performance in competitive examinations as well as on education and experience. The physical examinations often include tests of strength and agility.

Because personal characteristics such as honesty, good judgment, and a sense of responsibility are especially important in police work, candidates are interviewed by a senior officer at police headquarters, and their character traits and background are investigated. In some police departments, candidates also may be interviewed by a psychiatrist or a pyschologist, or be given a personality test. Although police officers work independently, they must perform their duties in line with laws and departmental rules. They should enjoy working with people and serving the public.

In large police departments, where most jobs are found, applicants usually must have a high school education. A few cities require some college training and some hire law enforcement students as police interns. A few police departments accept applicants who have less than a high school education as recruits, particularly if they have worked in a field related to law enforcement.

More and more, police departments are encouraging applicants to take post-high school training in sociology and psychology. As a result, more than 1,000 junior colleges, colleges, and universities now offer programs in law enforcement or criminal justice. Other courses helpful in preparing for a police career include English, American history, civics and government, business law, and physics. Physical education and sports are especially helpful in developing the stamina and agility needed for police work.

In some large cities, young persons who have completed high school can enter police work as police cadets, or trainees, while still in their teens. As paid civilian employees of the police department, they attend classes to learn police skills and do clerical work. They may be appointed to the regular force at age 21 if they have all the necessary qualifications.

Before their first assignments, officers usually go through a period of training. In small communities, recruits learn by working for a short time with experienced officers. Training provided in large city police departments is more formal and may last several weeks or a few months. This training includes classroom instruction in constitutional law and civil rights; in State laws and local ordinances; and in accident investigation, patrol, and traffic control. Recruits learn how to use a gun, defend themselves from attack, administer first aid, and deal with emergencies.

Police officers usually become eligible for promotion after a specified length of service. In a large department, promotion may allow an officer to specialize in one type of police work such as laboratory work, traffic control, communications, or work with juveniles. Promotions to the rank of sergeant, lieutenant, and captain usually are made according to a candidate's position on a promotion list, as determined by scores on a written examination and on-the-job performance.

Many types of training help police officers improve their performance on the job and prepare for advancement. Through training given at police department academies and colleges, officers keep abreast of crowd-control techniques, civil defense, legal developments that affect their work, and advances in law enforcement equipment. Many police departments encourage officers to work toward college degrees, and some pay all or part of the tuition.

Employment Outlook

Police work is attractive to many. The job frequently is challenging and involves much responsibility. Furthermore, layoffs are rare. In periods of relatively high unemployment, the number of persons seeking police employment may be greater than the number of openings. However, the written examinations and strict physical requirements always eliminate many applicants. The outlook should be good for persons having some college training in law enforcement.

Law enforcement is complex and requires an approach tailored to the particular problems of each city. The police department of a city with a large, mobile population is likely to emphasize traffic control, preventive patrol, and cooperation with police agencies in the surrounding areas. In smaller cities, or those with well-established communities and fewer employment and recreation centers, police work may be less specialized. In either case, however, the usual way of increasing police protection is to provide more officers for duty.

The number of officers employed will depend on the amount of money made available by local governments. Because police work is essential, it is likely that funding for law enforcement will have high priority, and that the employment of city police officers will rise faster than the average for other occupations through the mid-1980's.

Earnings and Working Conditions

In 1976, entry level salaries for police officers averaged nearly $11,300 a year, although they varied widely from city to city. In some smaller communities, officers started at less than $8,400 a year, while some major cities offered over $15,000 a year to new employees. Most officers receive regular salary increases during the first few years of employment until they reach a set maximum for their rank. Maximum earnings averaged $13,900 a year in 1976, and exceeded $17,000 a year in some areas.

Promotion to a higher rank brings a higher basic salary. The average starting salary for sergeants, for example, was almost $14,500 a year in 1976; more than $18,000 a year in the largest cities. Beginning salaries for lieutenants averaged more than $16,300 a year in 1976. In general, police officers are paid about 1 1/2 times as much as nonsupervisory workers in private industry, except farming.

Police departments usually provide officers with special allowances for uniforms and furnish revolvers, night sticks, handcuffs, and other required equipment.

The scheduled workweek for police officers usually is 40 hours. Because police protection must be pro-

vided around the clock in all but the smallest communities, some officers are on duty over weekends, on holidays, and at night. Police officers are subject to call any time their services are needed and may work overtime in emergencies. In some departments, overtime is paid at straight time or time and one-half, in others, officers may be given an equal amount of time off on another day of the week.

Police officers generally are covered by liberal pension plans, enabling many to retire at half pay by the time they reach age 55. In addition, paid vacations, sick leave, and health and life insurance plans frequently are provided.

Police officers may have to work outdoors for long periods in all kinds of weather. The injury rate is higher than in many occupations and reflects the risks officers take in pursuing speeding motorists, capturing lawbreakers, and dealing with public disorder.

Sources of Additional Information

Information about entrance requirements may be obtained from local civil service commissions or police departments.

Additional information describing careers as police officers is available from:

International Association of Chiefs of Police, 11 Firstfield Rd., Gaithersburg, Md. 20760.

State police officers usually take care of vehicle and traffic matters on the State's highways.

STATE POLICE OFFICERS

(D.O.T. 375.118, .138, .168, .228, .268, and .388)

Nature of the Work

The laws and regulations that govern the use of our Nation's roadways are designed to insure the safety of all citizens. State police officers (sometimes called State troopers) patrol our highways and enforce these laws.

State police officers issue traffic tickets to motorists who violate the law. At the scene of an accident, they direct traffic, give first aid, call for emergency equipment including ambulances, and write reports to be used in determining the cause of the accident.

In addition, State police officers provide services to motorists on the highways. For example, they radio for road service for drivers with mechanical trouble, direct tourists to their destination, or give information about lodging, restaurants, and tourist attractions.

State police officers also provide traffic assistance and control during road repairs, fires, and other emergencies, as well as during special occurrences such as parades and sports events. They sometimes check the weight of commercial vehicles, conduct driver examinations, and give information on highway safety to the public.

In addition to highway responsibilities, State police may investigate crimes, particularly in areas that do not have a local police force. They sometimes help city or county police catch lawbreakers and control civil disturbances. State highway patrols, however, normally are restricted to vehicle and traffic matters.

Some officers work with special State police units such as the mounted police, canine corps, and marine patrols. Others instruct trainees in State police schools, pilot police aircraft, or specialize in fingerprint classification or chemical and microscopic analysis of criminal evidence.

State police officers also write reports and maintain police records.

Some officers, including division or bureau chiefs responsible for training or investigation and those who command police operations in an assigned area, have administrative duties.

Places of Employment

About 48,000 State police officers were employed in 1976.

The size of State police forces varies considerably. The largest force (in California) has over 5,000 officers; the smallest (in North Dakota) has fewer than 100. One State (Hawaii) does not maintain a police force.

Training, Other Qualifications, and Advancement

State civil service regulations govern the appointment of State police officers. All candidates must be citizens of the United States. Other entry requirements vary, but most States require that applicants have a high school education or an equivalent combination of education and experience and be at least 21 years old.

Officers must pass a competitive examination and meet physical and personal qualifications. Physical requirements include standards of height, weight, and eyesight. Tests of strength and agility often are required. Because honesty and a sense of responsibility are important in police work, an applicant's character and background are investigated.

Although State police officers work independently, they must perform their duties in line with department rules. They should want to serve the public and be willing to work outdoors in all types of weather.

In all States, recruits enter a formal training program for several months. They receive classroom instruction in State laws and jurisdictions, and they study procedures for accident investigation, patrol, and traffic control. Recruits learn to handle firearms, defend themselves from attack, handle an automobile at high speeds, and give first aid. After gaining experience, some officers take advanced training in police science, administration, law enforcement, or criminology. Classes are held at junior colleges, colleges and universities, or special police institutions such as the National Academy of the Federal Bureau of Investigation.

High school and college courses in English, government, psychology, sociology, American history, and physics help in preparing for a police career. Physical education and sports are useful for developing stamina and agility. Driver education courses and military police training also are helpful.

Police officer recruits serve a probationary period ranging from 6 months to 3 years. After a specified length of time, officers become eligible for promotion. Most States have merit promotion systems that require officers to pass a competitive examination to qualify for the next highest rank. Although the organization of police forces varies from State to State, the typical avenue of advancement is from private to corporal, to sergeant, to first sergeant, to lieutenant, and then to captain.

In some States, high school graduates may enter State police work as cadets. These paid civilian employees of the police organization attend classes to learn various aspects of police work and are assigned nonenforcement duties. Cadets who qualify may be appointed to the State police force at age 21.

Employment Outlook

State police employment is expected to grow about as fast as the average for other occupations. Although most jobs will result from this growth, some openings will be created as officers retire, die, or leave the occupation for other reasons.

Although some State police will be needed in criminal investigation and other nonhighway functions, the greatest demand will be for officers to work in highway patrol. This is the result of a growing, more mobile population. In ever-increasing numbers, Americans are using the motor vehicle as a means of transportation and a source of recreation. Motorcycles, campers, and other recreational vehicles will continue to add to the Nation's traffic flow and require additional officers to insure the safety of highway users.

Because law enforcement work is becoming more complex, specialists will be needed in crime laboratories and electronic data processing centers to develop administrative and criminal information systems. However, in many departments, these jobs will be filled by civilian employees rather than uniformed officers.

Earnings and Working Conditions

In 1976, beginning salaries for State police officers averaged about $10,400 a year. Officers generally receive regular salary increases, based on experience and performance, until a specified maximum is reached. Maximum salaries averaged $13,600 a year in 1976, but ranged to more than $15,000 a year in some States. Although starting salaries are normally higher in the West and lower in the South, State police officers on the average earn about 1 1/2 times as much as nonsupervisory workers in private industry, except farming.

Earnings increase with promotions to higher ranks. State police sergeants received average starting salaries of $12,350 a year in 1976, and average maximum salaries of close to $15,800. Lieutenants received average starting salaries of $14,200 a year and average maximum salaries of more than $18,300.

State police agencies usually provide officers with uniforms, firearms, and other necessary equipment, or give special allowances for their purchase.

In many States, the scheduled workweek for police officers is 40 hours. Although the workweek is longer in some States, the trend is toward a 40-hour week. Since police protection must be provided around the clock, some officers are on duty over weekends, on holidays, and at night. Police officers also are subject to emergency calls at any time.

State police usually are covered by liberal pension plans. Paid vacations, sick leave, medical insurance, and life insurance plans frequently are provided.

The work of State police officers is sometimes dangerous. They always run the risk of an automobile accident while pursuing speeding motor-

ists or fleeing criminals. Officers also face the risk of injury while apprehending criminals or controlling disorders.

Sources of Additional Information

Information about specific entrance requirements may be obtained from State civil service commissions or State police headquarters, usually located in each State capital.

CONSTRUCTION INSPECTORS (GOVERNMENT)

(D.O.T. 168.168)

Nature of the Work

Federal, State, and local government construction inspectors insure that recognized standards of construction are observed in public and private construction. They inspect the construction, alteration, or repair of highways, streets, sewer and water systems, dams, bridges, buildings, and other structures to insure compliance with building codes and ordinances, zoning regulations, and contract specifications.

An inspector's job is to insure compliance with building codes and ordinances, zoning regulations, and contract specifications.

Construction inspectors visit worksites to inspect recently completed construction. On large projects, they generally are required to inspect each new stage of construction. Several members of large inspection staffs may be assigned to a single complex project.

Construction inspectors generally specialize in one particular type of construction work. Broadly categorized, these are building, electrical, mechanical, and public works.

Building inspectors inspect the structural quality of buildings. Some may specialize—for example, in structural steel or reinforced concrete buildings. Before construction, inspectors determine whether the plans for the building or other structure comply with local zoning regulations and are suited to the engineering and environmental demands of the building site. They visit the worksite before the foundation is poured to inspect the positioning and depth of the footings. They inspect the foundation after it has been completed. The size and type of structure and the rate of completion determine the number of other visits they must make. Upon completion of the project, they conduct a final comprehensive inspection.

Electrical inspectors inspect the installation of electrical systems and equipment to insure that they work properly and are in compliance with electrical codes and standards. They visit worksites to inspect new and existing wiring, lighting, sound and security systems, and generating equipment. They also may inspect the installation of the electrical wiring for heating and air-conditioning systems, kitchen appliances, and other components.

Mechanical inspectors examine plumbing systems including septic tanks, plumbing fixtures and traps, and water, sewer, and vent lines. They also inspect the installation of the mechanical components of kitchen appliances, heating and air-conditioning equipment, gasoline and butane tanks, gas piping, and gas-fired appliances. Some specialize in inspecting boilers, mechanical components, or plumbing.

Public works inspectors insure that Federal, State, and local government construction of water and sewer systems, highways, streets, bridges, and dams conforms to detailed contract specifications. They inspect excavation and fill operations, the placement of forms for concrete, concrete mixing and pouring, and asphalt paving. They also record the amount of work performed and materials used so that contract payment calculations can be made. Public works inspectors may specialize in inspection of highways, reinforced concrete, or ditches.

While inspections are primarily visual, inspectors often use tape measures, metering devices, concrete strength measurers, and other test equipment during inspections. They often keep a daily log of their work, file written reports, and, if necessary, act on their findings. For example, construction inspectors notify the construction contractor, superintendent, or supervisor when they discover a detail of a project that is not in compliance with the appropriate codes, ordinances, or contract specifications. If the deficiency is not corrected within a reasonable period of time, they have authority to issue a "stop-work" order.

Many inspectors also investigate reported incidents of "bootlegging," construction or alteration that is being carried on without proper permits. Violators of permit laws are directed to obtain permits and submit to inspection.

Places of Employment

About 22,000 persons worked as government construction inspectors in 1976. More than three-fourths worked for municipal or county building departments. Public works construction inspectors were employed primarily at the Federal and State levels.

The employment of local government construction inspectors is concentrated in cities and in suburban areas undergoing rapid growth. These governments employ large inspection staffs, including most of the inspectors who specialize in structural steel, reinforced concrete, and boiler inspection.

About half the construction inspectors employed by the Federal Government work for the Department of Defense, primarily for the U.S. Army Corps of Engineers.

Training, Other Qualifications, and Advancement

To become a construction inspector, several years of experience as a construction contractor, supervisor, or craft worker are generally required. Federal, State, and most local governments also require an applicant to have a high school diploma. High school preparation should include courses in drafting, mathematics, and English.

Workers who want to become inspectors should have a thorough knowledge of construction materials and practices in either a general area like structural or heavy construction, or in a specialized area such as electrical or plumbing systems, reinforced concrete, or structural steel; a significant number of construction inspectors have recent experience as carpenters, electricians, plumbers, or pipefitters.

Many employers prefer inspectors to be graduates of an apprenticeship program, to have studied at least 2 years toward an engineering or architectural degree, or to have a degree from a community or junior college, with courses in construction technology, blueprint reading, technical mathematics, English, and building inspection.

Construction inspectors must be in good physical condition in order to walk and climb about construction sites. They also must have a motor vehicle operator's license. In addition, Federal, State, and many local governments usually require that construction inspectors pass a civil service examination.

Construction inspectors receive most of their training on the job. During the first couple of weeks, working with an experienced inspector, they learn about inspection techniques; codes, ordinances, and regulations; contract specifications; and recordkeeping and reporting duties. They begin by inspecting less complex types of construction such as residential buildings. The difficulty of their assignments is gradually increased until they are able to handle complex assignments. An engineering degree is frequently needed in order to advance to supervisory inspector.

Since they advise representatives of the contruction industry and the general public on matters of code interpretation, construction practices, and technical developments, construction inspectors must keep abreast of new building code developments. The Federal Government and most State and large city governments conduct formal training programs for their construction inspectors to broaden their knowledge of construction materials, practices, and inspection techniques and to acquaint them with new materials and practices. Inspectors who work for small agencies that do not conduct training programs frequently can broaden their knowledge of construction and upgrade their skills by attending State-conducted training programs or by taking college or correspondence courses.

Employment Outlook

Employment of government construction inspectors is expected to grow faster than the average for all occupations through the mid-1980's. Because of the increasing complexity of construction technology and the trend toward the establishment of minimum professional standards for inspectors by State governments, job opportunities should be best for those who have some college education or who are currently employed as carpenters, electricians, or plumbers.

In addition to growth needs, job openings for construction inspectors will occur each year to replace those who die, retire, or leave the occupation for other reasons.

The number of new positions for construction inspectors will be largely affected by the level of new housing and commercial building activity. Because construction activity is sensitive to ups and downs in the economy, the number of job openings may fluctuate from year to year.

The demand for construction inspectors also should increase as they are given more responsibility for insuring safe construction of prefabricated buildings mass-produced in factories and assembled on the construction site.

Earnings and Working Conditions

Starting salaries of construction inspectors working in cities and towns averaged about $10,500 a year in 1974, according to a survey conducted by the Public Personnel Association. Top salaries for senior inspectors averaged $13,000. Salaries for supervisory inspectors were higher in large cities. Among geographic regions, the West had the highest average salaries, cities in the South the lowest.

In the Federal Government, construction inspectors started at $9,300 or $11,500 a year in 1977, depending on the amount and nature of their earlier work experience. Experienced construction inspectors were paid salaries ranging from $14,000 to $19,500, and more experienced workers were paid salaries ranging from $17,000 to over $22,000.

Construction inspectors often spend a large portion of their time traveling between worksites. Usually, an automobile is furnished for their use or their expenses are reimbursed if they use their own. Since they spend most of their time outdoors or in partially enclosed structures, they are exposed to all types of inclement weather.

Unlike the seasonal and intermittent nature of employment in many of the occupations associated with the construction industry, inspection work tends to be steady and year round. In 1976, according to limited information, unemployment was estimated to be less than 3 percent, a figure significantly lower than that for the Nation.

Sources of Additional Information

Persons seeking additional information on a career as a State or local government construction inspector should contact their State or local employment service, or:

International Conference of Building Officials, 5360 South Workman Mill Rd., Whittier, Calif. 90601.

Persons interested in a career as a construction inspector with the Fed-

eral Government can get information from:

Interagency Board of the U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

HEALTH AND REGULATORY INSPECTORS (GOVERNMENT)

(D.O.T. 168.168, and .287)

Nature of the Work

Protecting the public from health and safety hazards, prohibiting unfair trade and employment practices, and raising revenue are included in the wide range of responsibilities of government. Health and regulatory inspectors help insure observance of the laws and regulations that govern these responsibilities. For discussion of a third type of inspector, see the statement on construction inspectors (Government) elsewhere in the *Handbook*.

The duties, titles, and responsibilities of Federal, State, and local health and regulatory inspectors vary widely. Some types of inspectors work only for the Federal Government while others also are employed by State and local governments. Many other workers employed as accountants, agricultural cooperative extension service workers, and other agricultural professionals also have inspection duties.

Health Inspectors. Health inspectors work with engineers, chemists, microbiologists, and health workers to insure compliance with public health and safety regulations governing food, drugs, and various other consumer products. They also administer regulations that govern the quarantine of persons and products entering the United States from foreign countries. The major types of health inspectors are: Food and drug, meat and poultry, and agricultural quarantine inspectors. In addition, some inspectors work in a field that is closely related to food inspection—agricultural commodity grading.

Most *food and drug inspectors* specialize in one area of inspection such as food, feeds and pesticides, weights and measures, or drugs and cosmetics. Some, especially those who work for the Federal Government, may be proficient in several of these areas. Working individually or in teams under the direction of a senior or supervisory inspector, they travel throughout a geographical area to check periodically firms that produce, handle, store, and market food, drugs, and cosmetics. They look for evidence of inaccurate product labeling, decomposition, chemical or bacteriological contamination, and other factors that could result in a product becoming harmful to consumer health. They assemble evidence of violations, using portable scales, cameras, ultraviolet lights, container sampling devices, thermometers, chemical testing kits, and other types of equipment.

Product samples collected as part of their examinations are sent to laboratories for analysis. After completing their inspection, inspectors discuss their observations with the management of the plant and point out any areas where corrective measures are needed. They prepare written reports of their findings, and, when necessary, compile evidence that may be used in court if legal actions must be taken to effect compliance with the law.

Federal and State laws empower *meat and poultry inspectors* to inspect meat, poultry, and their byproducts to insure that they are wholesome and safe for public consumption. Working as part of a constant onsite team under the general supervision of a veterinarian, they inspect meat and poultry slaughtering, processing, and packaging operations. They also check to see that products are labeled correctly and that proper sanitation is maintained in slaughtering and processing operations.

Agricultural quarantine inspectors protect American agricultural products from the introduction and spread of foreign plant pests and animal diseases. To safeguard crops, forests, and gardens, they inspect ships, aircraft, railroad cars, and motor vehicles entering the United States for the presence of restricted or prohibited plant or animal materials.

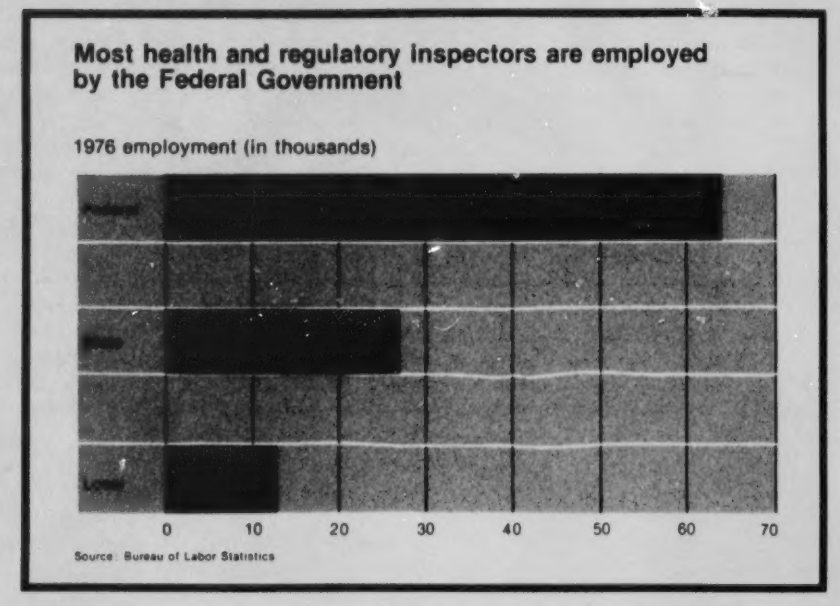
Environmental health inspectors, or sanitarians, work primarily for State and local governments. These inspectors perform a variety of inspection duties to help insure that the food people eat, the water they drink, and the air they breathe meet government standards. They check the cleanliness and safety of food and beverages produced in dairies and processing plants, or served in restaurants, hospitals, and other institutions. They often examine the handling, processing, and serving of food for compliance with sanitation rules and regulations.

Environmental health inspectors concerned with waste control oversee the treatment and disposal of sewage, refuse, and garbage. They examine places where pollution is a danger, perform tests to detect pollutants, and collect air or water samples for analysis. They determine the nature and cause of the pollution, then initiate action to stop it.

In large local and State health or agriculture departments, environmental health inspectors may specialize in areas of work such as milk and dairy products, food sanitation, waste control, air pollution, institutional sanitation, and occupational health. In rural areas and small cities, they may be responsible for a wide range of environmental health activities.

Agricultural commodity graders apply quality standards to various commodities to insure that retailers and consumers receive good and reliable products. They generally specialize in an area such as eggs and egg products, processed or fresh fruits and vegetables, grain, or dairy products. They inspect samples of a particular product to determine its quality and grade, and issue official grading certificates. Graders also may inspect the plant and equipment to insure that adequate sanitation standards are maintained.

Regulatory Inspectors. Regulatory inspectors insure compliance with various laws and regulations that protect the public welfare. Important types of regulatory inspectors are: Immigration; customs; aviation safe-



ty; mine; wage-hour compliance; alcohol, tobacco, and firearms; and occupational safety inspectors.

Immigration inspectors interview and examine people seeking admission, readmission, or the privileges of passing through or residing in the United States. They inspect the passports of those seeking to enter the United States to determine whether they are legally eligible to enter and to verify their citizenship, status, and identity. Immigration inspectors also prepare reports, maintain records, and process applications and petitions by aliens for privileges such as immigrating to or living temporarily in the United States.

Customs inspectors enforce the laws governing U.S. imports and exports. Stationed at airports, seaports, and border crossing points, they count, weigh, gauge, measure, and sample commercial cargoes entering and leaving the United States to determine the amount of tax that must be paid. They also inspect baggage and articles worn or carried by the passengers and crew of ships, aircraft, and motor vehicles to insure that all merchandise being brought through ports of entry is declared and the proper taxes paid.

Aviation safety officers insure that Federal Aviation Administration (FAA) regulations that govern the quality and safety of aircraft equipment and personnel are maintained. Aviation safety officers may inspect aircraft manufacturing, maintenance, or operations procedures. They usually specialize in inspecting either commercial or general aviation aircraft. They are responsible for the inspection of aircraft manufacturing and of major repairs. They also certify aircraft pilots and schools, pilot examiners, flight instructors, and instructional materials.

Mine inspectors work to insure the health and safety of miners and to promote good mining practices. To insure compliance with safety laws and regulations, mine inspectors visit mines and related facilities to obtain information on health and safety conditions.

Mine inspectors discuss their findings with the management of the mine, prepare written reports that incorporate their findings and decisions, and issue notices of findings that describe violations and hazards that must be corrected. They also investigate and prepare reports on mine accidents and direct rescue and firefighting operations when fires or explosions occur.

Wage-hour compliance officers inspect the employer's time, payroll, and personnel records to insure compliance with the provisions of various Federal laws on minimum wages, overtime, pay, employment of minors, and equal employment opportunity. They often interview employees to verify the employer's records and to check for any complaints.

Alcohol, tobacco, and firearms inspectors insure that the industries which manufacture these products comply with the provisions of revenue laws and other regulations on operating procedures, unfair competition, and trade practices. They spend most of their time inspecting distilleries, wineries, and breweries; cigar and cigarette manufacturing plants; wholesale liquor dealers and importers; firearms and explosives manufacturers, dealers, and users; and other regulated facilities. They periodically audit these establishments to determine that appropriate taxes are correctly determined and paid.

Places of Employment

About 115,000 persons worked as health and regulatory inspectors in 1976. Nearly two-thirds of all health and regulatory inspectors work for the Federal Government, although State and local governments also employ large numbers. The largest single employer of food and drug inspectors is the U.S. Food and Drug Administration, but the majority work for State governments. Meat and poultry inspectors and commodity graders who work in processing plants are employed mainly by the U.S. Department of Agriculture. Agricultural quarantine inspectors work either for the U.S. Public Health Service or the U.S. Department of Agriculture. Environmental health inspectors work primarily for State and local governments.

Regulatory inspectors work for various agencies within the Federal Government, mainly in regional and district offices throughout the United States. Aviation safety officers work for the Federal Aviation Administration; wage-hour compliance officers, for the Department of Labor; mine inspectors, the Department of the Interior; and alcohol, tobacco, and firearms inspectors, the Treasury Department. Immigration, customs, and agricultural quarantine inspectors work at U.S. airports, seaports, border crossing points, and at foreign airports and seaports. They are employed by the Justice and Treasury Departments.

Training, Advancement, and Other Qualifications

Because inspectors perform such a wide range of duties, qualifications for employment in these positions vary greatly. The Federal Government requires a passing score on the Professional and Administrative Career Examination (PACE) for several inspector occupations, including immigration; customs; wage and hour compliance; alcohol, tobacco, and firearms; occupational safety; and consumer safety (food and drug). To take this examination, a bachelor's degree or 3 years of responsible work experience, or a combination of the two, are required. In some cases, agencies will give preference to an applicant whose course work or work experience is related to the field of employment.

Other Federal inspectors must pass an examination based on specialized knowledge, in addition to having work experience in related fields. These include commodity inspectors such as those in meat, poultry, livestock, and egg products.

Air safety inspectors must have considerable experience in aviation maintenance, and an FAA Air Frame and Power Plant certificate. In addition, various pilot certificates and considerable flight experience are required, with the type dependent on the inspection duties. Many air safety inspectors receive both their flight training and mechanical training in the Armed Forces. No written examination is required.

Applicants for mine safety inspector positions generally must have specialized work experience in mine management or supervision, or possess a skill such as electrical engineering (for mine electrical inspectors). In some cases, a general aptitude test may be required.

Some Civil Service registers, including those for agricultural quarantine inspectors and fruit and vegetable graders, rate applicants solely on their experience and education and require no written examination.

Qualifications for inspectors at the State and local level usually are similar to those for Federal employees. However, this may vary among government employers, particularly at the local level. Environmental health inspectors, called sanitarians in many States, must have a bachelor's degree in environmental health or the physical or biological sciences. In 35 States, they are licensed and their qualifications regulated by examining boards.

All inspectors are trained in the laws and inspection procedures related to their specific field through a combination of classroom and on-the-job training. In general, people who want to become health and regulatory inspectors should be able to accept responsibility and like detailed work. They should be neat and personable and able to express themselves well orally and in writing.

All Federal Government inspectors are promoted on a Civil Service "career ladder." This means that, assuming satisfactory work performance, workers will advance automatically, usually at 1-year intervals, to a specified maximum level. Above this level (usually supervisory positions), advancement is competitive, based on needs of the agency and individual merit.

Employment Outlook

Employment of health and regulatory inspectors as a group is expected to increase faster than the average for all occupations through the mid-1980's. The growth in employment of health inspectors is expected to be more rapid than that of regulatory inspectors. In addition to job opportunities stemming from growth, many inspectors will be needed each year to replace those who die, retire, or transfer to other occupations.

Increased food consumption caused by population growth and greater public concern over potential health hazards should create additional jobs for food and drug, meat and poultry, and other commodity inspectors and graders. Public concern for improved quality and safety of consumer products also should result in new legislation in these areas, requiring additional inspectors to insure compliance.

Aviation industry growth, increased international travel, and increases in the volume of U.S. imports and exports should continue to create new openings for aviation safety officers, quarantine and immigration inspectors, and customs inspectors. Increasing coal mining activity and concern over mine safety should create additional mine inspector jobs. Continued public pressure for equal employment rights should cause a growing need for wage-hour compliance officers.

Earnings and Working Conditions

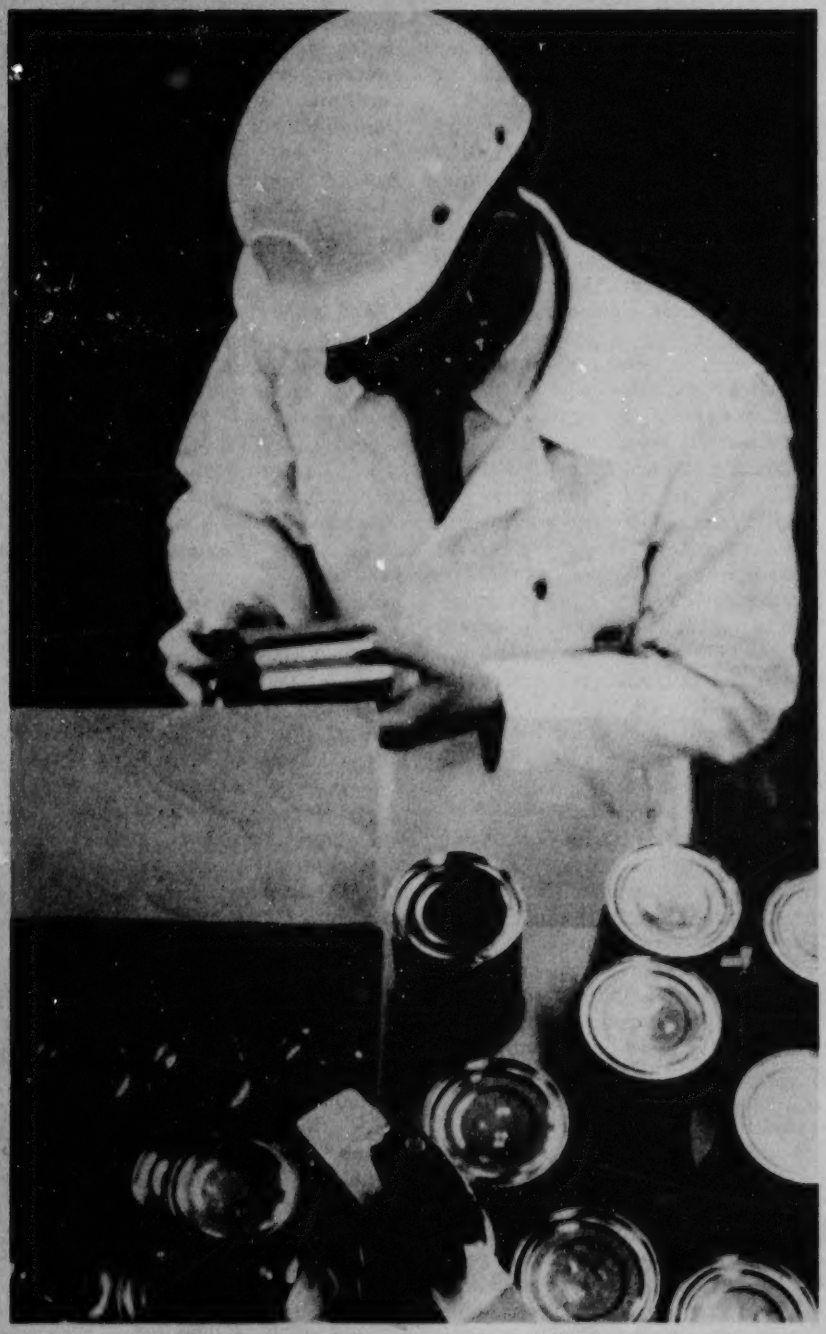
With the exception of mine inspectors and aviation safety officers, the Federal Government paid health and regulatory inspectors and graders starting salaries of $9,303 or $11,523 a year in 1977, depending on the type of position and the qualifications of the applicant. Aviation safety officers and mining inspectors usually received starting salaries of $14,097.

Salaries of experienced meat and poultry inspectors, egg product inspectors, agricultural quarantine inspectors, alcohol, tobacco, and firearms inspectors, and customs and immigration inspectors were over $14,000 a year in 1977. Experienced food and drug inspectors (consumer safety officers), mine inspectors, and wage-hour compliance officers usually received salaries of about $20,000 from the Federal Government in 1977. Experienced aviation safety officers averaged over $24,000 a year.

Nonsupervisory environmental health inspectors working for selected U.S. cities and counties received average starting salaries about $11,000 in 1976; those working for State governments started at about $1,000 less. Experienced environmental health inspectors working for State governments earned between $11,500 and $15,200, but those in top supervisory and administrative positions had salaries between $15,500 and $20,500 in 1976.

Most health and regulatory inspectors live an active life, meeting many people and working in a variety of environments. Many travel frequently and are usually furnished with an automobile or reimbursed for travel expenses.

At times inspectors must work under unfavorable working conditions. For example, meat and poultry, and alcohol, tobacco, and firearms in-



Public concern for improved quality and safety of consumer products will require additional inspectors to insure compliance.

spectors frequently come in contact with strong, unpleasant odors; mine inspectors often spend a great deal of time in mines where they are exposed to the same hazards as miners. Many inspectors work long and often irregular hours.

Sources of Additional Information

For facts about inspector careers in the Federal Government, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

More detailed information on qualifications for Federal jobs is available from local Civil Service Commission offices or from individual Federal agencies.

Information about career opportunities as inspectors in State and local governments is available from State civil service commissions, usually located in each State capital, or from local government offices.

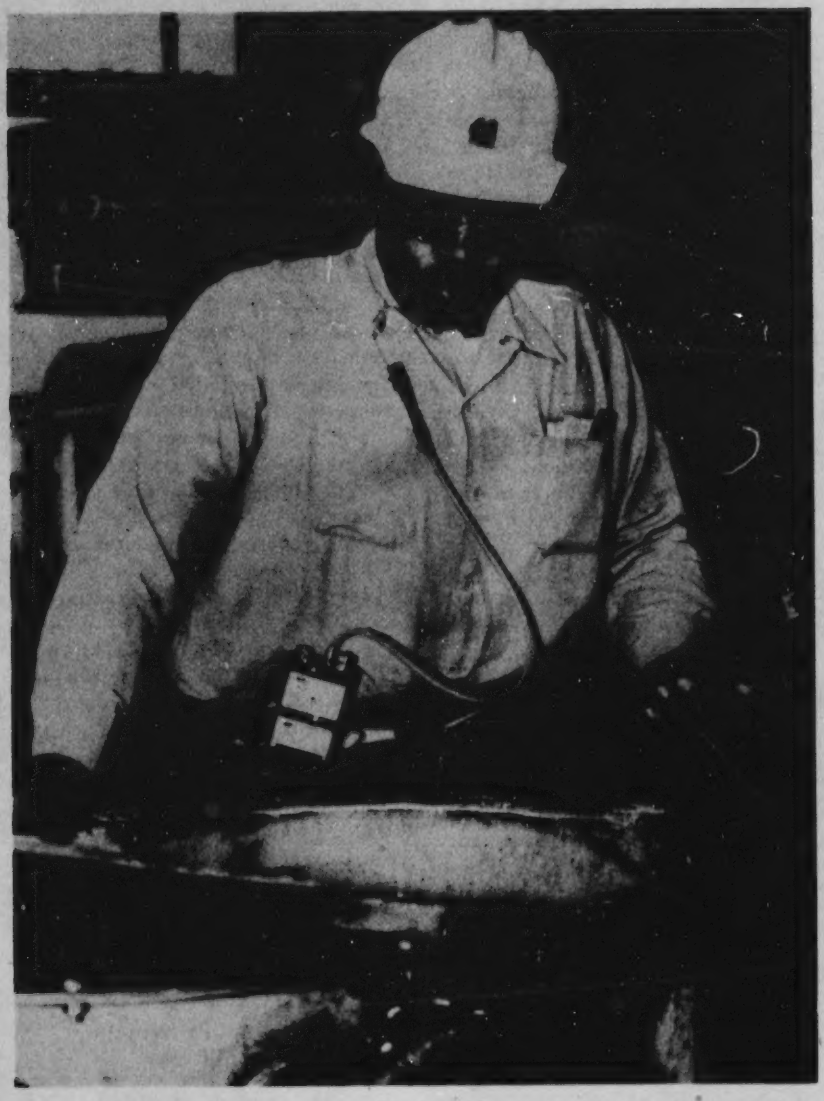
OCCUPATIONAL SAFETY AND HEALTH WORKERS

(D.O.T. 010.081; 012.081 and .188; 079.188; 168.168, .268, and .284; 379.387; 821.387; and 909.128)

Nature of the Work

People in the occupational safety and health field have the challenging job of insuring a safe and healthful environment for workers and safe products for consumers. Safety and health workers in a number of different occupations strive to control occupational accidents and diseases, property losses, and injuries from unsafe products. This statement discusses occupations in private industry; for a discussion of related occupations in government, see the statement on health and regulatory inspectors elsewhere in the *Handbook*.

The largest group of safety workers is *safety engineers*. Although all of them are concerned with preventing accidents, their specific tasks depend on where they work. For example, the safety engineer working in a large manufacturing plant (D.O.T. 012.081) may develop a comprehensive safety program covering several thousand employees. This usually entails detailed analysis of each job in the plant to identify potential hazards so that preventive measures can be taken. When accidents do occur, safety engineers in manufacturing plants investigate to determine the cause. If poor design, improper maintenance, or mechanical failure is involved, they use their technical skills to correct the situation and prevent its recurrence. When human error is



Safety engineer inspecting plant machinery for potential hazards.

the cause of an accident, safety engineers may establish training courses for plantworkers and supervisors or reemphasize existing ones.

Safety engineers who work for trucking companies (D.O.T. 909.128) study schedules, routes, loads, and speeds to determine their influence on trucking accidents. They also inspect heavy rigs, such as trucks and trailers, to suggest ways of safer operation. In the mining industry, safety engineers (D.O.T. 010.081) may inspect underground or open-pit areas to insure compliance with State and Federal laws, design protective equipment and safety devices for mine machinery, or lead rescue activities during emergencies.

Many safety engineers are directly concerned with the safety of their company's product. They work closely with design engineers to develop models that meet all safety standards, and they monitor the manufacturing process to insure the safety of the finished product.

Safeguarding life and property against loss from fire, explosion, and related hazards is the job of the *fire protection engineer* (D.O.T. 012.188). Those who specialize in research investigate problems such as fires in high-rise buildings or the manufacture, handling, and storage of flammable materials. Fire protection engineers in the field use these research findings to identify hazards and devise ways to correct them. For example, new findings concerning flashpoints (the temperatures at which different materials will ignite) are valuable to the engineer designing storage facilities in a chemical plant.

Like safety engineers, fire protection engineers may have different job duties depending on where they work. One who works for a fire equipment manufacturing company may design new fire protection devices, while engineers in consulting firms work with architects and others to insure that fire safety is built into new structures. In contrast, fire protection engineers working for insurance rating bureaus (organizations that calculate basic costs of insurance coverage in particular areas) inspect private, commercial, and industrial properties to evaluate the adequacy of fire protection for the entire area. Many fire protection engineers have special expertise in one area or more of fire protection, such as sprinkler or fire detection systems.

Losses in the workplace cannot be reduced without measures to eliminate hazards to workers' health. Designing and maintaining a healthful work environment is the job of the *industrial hygienist* (D.O.T. 079.188). These health professionals are concerned with how noise, dust, vapors, and other hazards common to the industrial setting affect workers' health. After a problem is detected, perhaps by analyzing employee medical records, the industrial hygienist at the jobsite may take air samples, monitor noise levels, or measure radioactivity levels in the areas under investigation.

Other industrial hygienists work in private laboratories or in those maintained by large insurance companies or industrial firms. Laboratory hygienists analyze air samples, do research on the reliability of health equipment such as respirators, or investigate the effects of exposure to chemicals or radiation. Some hygienists specialize in problems of air and water pollution. For example, these

health professionals may work with government officials, environmental groups, labor organizations, and plant management to develop a system to screen harmful substances before they enter and pollute a river.

Loss control and *occupational health consultants* (D.O.T. 168.168) in property-liability insurance companies perform many services for their clients. These range from correcting a single hazard in a small business to devising a program to eliminate or reduce all losses arising out of a large firm's operation. When dealing with a new account, the consultant makes a thorough inspection of the plant and then confers with management to formulate a program that meets the company's needs. The consultant may, for example, help set up plant health programs and medical services, assist plant personnel to insure that a new facility meets all safety requirements, or train plant safety people. Safety and health consultants also help their company's underwriters determine whether a risk is acceptable and the amount of premium to charge.

Places of Employment

An estimated 28,000 persons were engaged in occupational safety and health work in 1976. About one-quarter of these carried the professional designations, Certified Safety Professional; Certified Industrial Hygienist; or Member, Society of Fire Protection Engineers. Many others who are not certified performed professional level work, while a relatively small number were employed in the occupational safety and health field as technicians and inspectors. Property and liability insurance companies employ many occupational safety and health workers to provide engineering, consulting, and inspection services to their clients. Others worked for a variety of industrial, manufacturing, and commercial concerns.

These workers are needed wherever large numbers of people are concentrated and industrial development occurs. Insurance consultants generally have their headquarters in a region's major city and travel to and from the sites they visit.

Training, Other Qualifications, and Advancement

Entry level safety and health professionals generally need at least a bachelor's degree in engineering or science. A more specialized degree, such as one in safety management, industrial safety, or fire protection engineering, often is helpful in getting a good job. Many employers prefer applicants with a graduate degree in areas such as industrial hygiene, safety engineering, or occupational safety and health engineering, or those with prior industrial work experience. Some employers will hire graduates of 2-year college curriculums as technicians, particularly if they have work experience related to the job.

Continuing education is necessary to stay abreast of changing technologies, new ideas, and emerging trends. Many insurance companies offer training seminars and correspondence courses for their staffs. The Occupational Safety and Health Administration (OSHA) conducts courses for safety and health workers on topics such as occupational injury investigation and radiological health hazards. The recognized marks of achievement in the field are the designations Certified Safety Professional; Certified Industrial Hygienist; and Member, Society of Fire Protection Engineers. Certification is conferred by the Board of Certified Safety Professionals, the American Board of Industrial Hygiene, or the Society of Fire Protection Engineers after the candidate completes the required experience and passes an examination.

In addition to possessing technical competence, safety and health workers must be able to communicate well and motivate others. They should be able to adapt quickly to different situations, being equally at ease with a representative of a local union, a supervisor in the welding shop, or a corporate executive. Because physical activity is basic to the job, good physical condition is necessary.

In the insurance industry, safety and health workers can be promoted to department manager in a small branch office, move up to larger branch offices, and finally take an executive position in the home office. In industrial firms, they can advance to plant safety and health manager or corporate manager over several plants. Although extensive experience is required, technicians can advance to professional safety and health positions.

Employment Outlook

Employment of safety and health workers is expected to increase faster than the average for all occupations through the mid-1980's as growing concern for occupational safety and health and consumer safety continues to generate programs and jobs. Many openings will arise also to replace workers who die, retire, or leave their jobs for other reasons.

Much of the employment growth is expected to occur in industrial and manufacturing firms. Many firms now without a safety and health program are expected to establish one, and others will upgrade and expand existing programs in response to government requirements, union interest, and rising insurance costs. The number of safety and health workers in casualty insurance companies also will increase as more small employers request the services of their insurer's engineering or loss control department. Prospects should be best for graduates of occupational safety or health curriculums.

Earnings and Working Conditions

Salaries of safety and health workers vary widely according to education, experience, and specialty. In manufacturing firms, persons with a bachelor's degree generally started at between $12,000 and $15,000 a year in 1976, according to the limited data available. Those with a graduate degree usually received higher starting salaries, and technicians somewhat lower ones. Safety and health workers with several years' experience averaged $18,000 to $22,000, and corporate managers well over $25,000 a year.

The amount of travel required depends upon job specialty and geographic location. For example, the plant safety engineer may travel only to seminars and conferences, while

the insurance consultant may spend about half the time traveling between worksites. Usually, a car is furnished or workers are reimbursed for the expenses of using their own vehicles.

Sources of Additional Information

For general information about safety careers, write to:

American Society of Safety Engineers, 850 Busse Highway, Park Ridge, Ill. 60068.

Also available from the Society is a booklet that lists colleges and universities offering degree programs in the occupational safety and health field.

Information concerning a career in industrial hygiene is available from:

American Industrial Hygiene Association, 66 S. Miller Rd., Akron, Ohio 44313.

Career information concerning fire protection engineering may be obtained from:

Society of Fire Protection Engineers, 60 Batterymarch St., Boston, Mass. 02110.

Career information on insurance loss control consulting is available from the home offices of many property-liability insurance companies.

The National Institute for Occupational Safety and Health of the U.S. Public Health Service provides general information on requirements for various careers in the occupational safety and health field, as well as lists of college and universities that award degrees in the various occupational safety and health disciplines. This information is available from:

Division of Training and Manpower Development, National Institute for Occupational Safety and Health, Robert A. Taft Laboratories, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

OTHER SERVICE OCCUPATIONS

MAIL CARRIERS

(D.O.T. 233.138 and 233.388)

Nature of the Work

Most mail carriers travel planned routes delivering and collecting mail. Carriers start work at the post office early in the morning, where they spend a few hours arranging their mail for delivery and taking care of other details.

A carrier may cover the route on foot, by vehicle, or a combination of both. On foot, they tote a heavy load of mail in a satchel or push it in a cart. In outlying suburban or rural areas a car or small truck is used to deliver mail. Residential carriers cover their routes only once a day, but carriers assigned to a business district may make two trips a day. Deliveries are made house-to-house, to roadside mailboxes, and to large buildings, such as apartments, which have all the mailboxes on the first floor.

Besides making deliveries, carriers collect postage-due and c.o.d. fees and obtain signed receipts for registered, certified, and sometimes for insured mail. If a customer is not home the carrier leaves a notice that tells where special mail is being held.

After completing their routes, carriers return to the post office with mail gathered from street collection boxes and homes. They turn in the accountable mail receipts and money collected during the day and may separate letters and parcels so that they can be canceled easily, and they turn in the receipts and money collected.

Many carriers have more specialized duties. Some deliver only parcel post while others collect mail from street boxes and office mail chutes. In contrast, rural carriers provide a wide variety of postal services. In addition to delivering and picking up mail, they sell stamps and money orders and accept parcels and letters to be registered or insured.

All carriers answer customers' questions about postal regulations and service and provide change-of-address cards and other postal forms when requested.

Training, Other Qualifications, and Advancement

Mail carriers must be at least 18 and qualify on a four-part written examination. The first part tests clerical accuracy by asking the applicant to compare pairs of add7esses and indicate which are identical. The second part tests ability to memorize mail distribution systems. The third measures reading ability, including vocabulary, and the fourth tests ability to do simple arithmetic.

If the carrier job involves driving, applicants must have a driver's license, a good driving record, and pass a road test. Before appointment, mail carriers must pass a physical examination and may be asked to show that they can lift and handle mail sacks weighing up to 70 pounds.

Applicants for mail carrier jobs should apply at the post office where they wish to work because each post officeeeps a separate list of those who have passed the examination. Applicants' names are listed in order of their scores. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. When a vacancy occurs, the appointing officer chooses one of the top three applicants; the rest of the names remain on the list to be considered for future openings.

Mail carriers are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help deliver mail during peak mailing periods during the year. Part-time flexible employees do not have a regular work schedule but replace absent workers and help with extra work as the need arises. Part-time regulars have a set work schedule—for example, 4 hours a day.

New carriers are trained on the job. They may begin as part-time flexible city carriers and become regular or full-time carriers in order of seniority as vacancies occur. Advancement possibilities are limited, but carriers can look forward to obtaining preferred routes or higher level jobs such as carrier technician as their seniority increases. A relatively small number of carriers become supervisors.

Employment Outlook

Employment of mail carriers—who numbered 250,000 in 1976—is expected to change very little through the mid-1980's. Although the number of homes and business establishments is expected to increase along with growth in population and business activity, anticipated cutbacks in the frequency of mail delivery should limit the need for additional carriers. Most job openings will result from the need to replace experienced carriers who retire, die, or transfer to other occupations. Openings will be concentrated in metropolitan areas.

Earnings and Working Conditions

Part-time flexible carriers began at $6.18 an hour in 1976, with periodic increases up to $7.46 an hour after 8 years of satisfactory service. Hourly wages of part-time regular workers were $5.97 an hour, with periodic increases up to $7.21 an hour after 8 years of service. Full-time carriers were paid on an annual basis, beginning at $12.42 and increasing to a maximum of $15,007 after 8 years. Rural carriers are paid time-and-one-half for each hour they work over 40 hours a week or for each route mile over 42 miles. They also receive an allowance of 18 cents a mile for the use of their automobiles. Substitute rural carriers receive the same pay as the regular carriers whose routes they are covering. Rural carriers work either a 5- or 6-day week.

Carriers can work at their own pace as long as they cover their routes on time.

A full-time city carrier works an 8-hour day 5 days a week. City carriers who work more than 8 hours a day or 40 hours a week also are paid 1 1/2 times their regular rate of pay for the extra hours. City carriers also receive 10 percent additional pay for work between 6 p.m. and 6 a.m.

Most carriers begin work early in the morning, in some cases as early as 4 a.m. if they have routes in the business district. Carriers spend most of their time outdoors in all kinds of weather delivering mail. Even those who drive often must walk when making deliveries, and must lift heavy sacks of parcel post when loading their vehicles.

The job, however, has its advantages. Carriers who begin work early in the morning are through by early afternoon. They are also free to work at their own pace as long as they cover their routes within a certain period of time. Moreover, full-time postal employees have more job security than workers in most other industries.

(For information on fringe benefits, see the statement on Postal Service occupations elsewhere in the *Handbook*.)

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities for mail carriers.

TELEPHONE OPERATORS

Nature of the Work

Although millions of telephone numbers are dialed directly each day, there are times when making a call requires the assistance of a telephone operator. Often an operator is needed because a caller wants to reverse long-distance charges, locate a telephone number in another city, or know the cost of a call. Operators also may be needed to contact the police or fire department in an emergency or arrange a conference call for business executives.

Providing these service are two groups of telephone operators. The operators who work in telephone company central offices probably are the most familiar. But many business and large organizations receive so many calls that they also employ operators to run their private branch exchange (PBX) switchboards. Sometimes operators place calls by inserting and removing plugs that make switchboard connections and by listening and speaking into their headsets. However, many switchboards, especially those in telephone company central offices, are now operated by pushbuttons or dials.

Telephone company operators may be assigned either to handle long-distance calls or to give directory assistance. Long-distance opera-

During peak calling periods, the pace at the switchboard may be very hectic.

tors obtain the information needed to complete the call, make the necessary connections, and record the details for billing. *Directory assistance operators* (D.O.T. 235.862) look up and provide telephone numbers. Service assistants train and help new operators to complete difficult calls.

PBX operators (D.O.T. 235.862) run switchboards for business offices and other establishments. They connect interoffice or house calls, answer and relay outside calls, assist company employees in making outgoing calls, supply information to callers, and record charges. In many small establishments, PBX operators work at switchboards that serve only a limited number of telephones. These operators may do other office work such as typing or sorting mail and many also act as receptionists or information clerks. (The work of receptionists is described elsewhere in the *Handbook*.)

Places of Employment

About 340,000 telephone operators were employed in 1976. More than one-half worked as PBX operators in manufacturing plants, hospitals, department stores, or businesses. The remainder worked in telephone companies. About one-fourth of all operators work only part time.

Both telephone company and PBX operators are concentrated in heavily populated areas. Nearly one-fifth work in the New York, Chicago, and Los Angeles metropolitan areas.

Training, Other Qualifications, and Advancement

Persons planning to become telephone operators should like to serve the public, be pleasant and courteous, and not mind sitting at a switchboard for long periods. A clear and pleasing voice and good hearing also are important. Many telephone companies and business firms require applicants, including operators, to pass physical examinations. High school courses in speech, office practices, and business math provide a helpful background for persons interested in this occupation.

New operators are taught on the job how to use the equipment and keep records of calls. Once they have learned the procedure, they put through practice calls. Instruction and practice usually last from 1 to 3 weeks. Operators then are assigned to regular operator jobs and receive further instruction from supervisors.

PBX operators who handle routine calls may have a somewhat shorter training period than telephone company operators. In large businesses, an instructor from the local telephone company may train new employees.

Experienced telephone company operators may be promoted to supervisory jobs or transfer to clerical occupations such as secretary or bookkeeper. They also may have the opportunity to advance to jobs as telephone craft workers such as telephone installers and repairers. PBX operators in large firms may advance to more responsible clerical positons; however, in many small business, opportunities for advancement usually are very limited.

Employment Outlook

Employment of telephone and PBX operators as a group is expected to decline slightly through the mid-1980's. Nevertheless, thousands of full-time and part-time workers will be hired each year to replace experienced operators who die, retire, or stop working for other reasons. Many other openings will result from the need to replace operators who advance to other occupations.

Employment of telephone company operators is expected to decline more than employment of PBX operators. As more telephone companies start charging customers for directory assistance and information calls, more people will dial numbers directly and use telephone directories to locate unknown numbers, thus reducing the need for operators. Also, technological improvements will limit the employment of operators. For example, more telephone companies are installing electronic switching systems in their central offices, thus reducing the need for manual switching of calls. In addition, traffic service position systems are being added, which automatically feed data about each telephone connection, such as the length and cost of the call, into a computer that processes the billing statements. Formerly this information was tabulated by an operator and then transferred to the statement.

Even though more small businesses will require PBX services, employment growth of PBX operators will be limited as many large businesses

convert to Central Exchange (CENTREX). With CENTREX, incoming and outgoing calls can be dialed directly without an operator's assistance.

Earnings and Working Conditions

Telephone company operators in training averaged $3.75 an hour in late 1975; experienced operators $4.90; service assistants $5.92; and supervisors or chief operators, $8.63. Contracts between unions and telephone companies generally provide for periodic pay increases and extra pay for work on evenings, Sundays, and holidays.

Most telephone company and PBX operators work between 35 and 40 hours a week. Often, their scheduled hours are the same as those of other office clerical workers. In telephone companies, however, and in hotels, hospitals, and other places where telephone service is needed on a 24-hour basis, operators work on shifts and on holidays and weekends. Some operators work split shifts—that is, they are on duty during the peak calling periods in the late morning and early evening, and have time off between these two periods.

Operators usually work in well-lighted and pleasant surroundings. The job of a telephone operator does not require any physical exertion; however, during the peak calling periods in the late morning and late afternoon, the pace at the switchboard may be very hectic. Often operators are unable to leave their seats during these periods.

Insurance, pension programs, holidays, vacations, and other fringe benefits are much the same as those for other types of clerical employees. For specific information about fringe benefits for telephone company operators, see the statement on the telephone industry elsewhere in the *Handbook*.

Many operators employed by telephone companies are members of the Communications Workers of America, the International Brotherhood of Electrical Workers, and the Telecommunications International Union.

Sources of Additional Information

For more details about employment opportunities, contact the telephone company in your community or local offices of the unions that represent telephone workers. For general information on telephone operator jobs, write to:

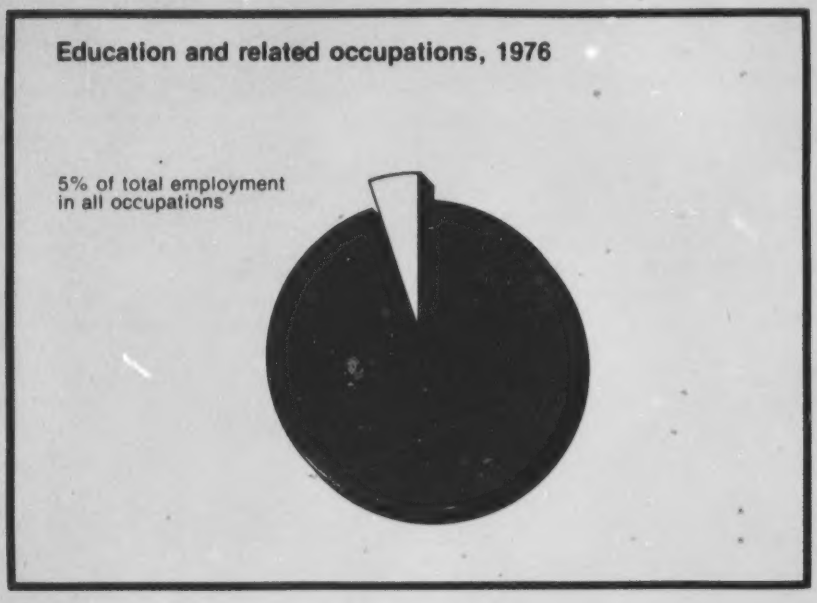
Telecommunications International Union, P.O. Box 5462, Hamden, Conn. 06518.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

EDUCATION AND RELATED OCCUPATIONS

The importance of an education has grown considerably since the birth of our Nation. Once primarily an agrarian economy, we have evolved into a highly sophisticated, technical, and urban society. Machinery and products never envisioned before are constantly being invented, calling for new jobs and skills to produce and use them. As a result, more educated workers are needed to fill a variety of positions at all levels of society.



In addition, as our economy has prospered, it has allowed people more time for personal development and leisure. No longer required to labor from early morning until dusk, workers have sought new avenues for personal enrichment. Adult education and craft courses, for example, draw increasingly larger numbers of interested students.

Teachers, teacher aides, and librarians play vital roles in the education of people of all ages. In large urban classrooms or rural county libraries, teachers and librarians are the people we turn to for information. These occupations are discussed in the following sections.

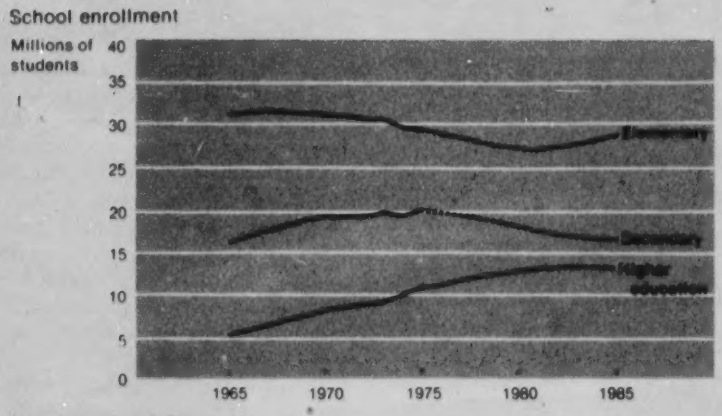
TEACHING OCCUPATIONS

Most people would agree that education is a life-long process. At every age we learn from our friends, family, and associates. We also teach others along the way, often unwittingly. But perhaps our most influential educational experiences occur during the years of formal education. During those years, students explore themselves and learn about many subjects. They make career decisions and train for productive work. Most significantly, they learn to think for themselves.

Today, more than 3 million teachers are involved at all levels of this educational process. Teachers work with people of all ages in a variety of different subjects. Some teach youngsters in their first years away from home, while others work primarily with adults who are taking courses to expand or change their job potential, or as a source of recreation. Some teachers are members of other professions who instruct part time.

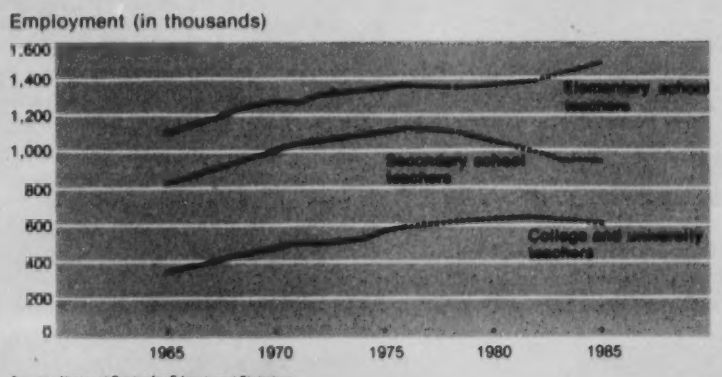
Detailed information on teaching occupations and the outlook for teachers through the mid-1980's is presented in the following statements.

Changing enrollment levels will be the primary factors affecting employment of teachers through 1985



Source: National Center for Educational Statistics

Employment of teachers generally will follow enrollment trends, rising or falling according to the number of students through 1985



Source: National Center for Educational Statistics

KINDERGARTEN AND ELEMENTARY SCHOOL TEACHERS

(D.O.T. 092.228)

Nature of the Work

Kindergarten and elementary school teachers play a vital role in the development of children. What is learned or not learned in these early years can, to a large measure, shape students' views of themselves, the world and the process of education.

Kindergarten and elementary school teachers must introduce children to the basic concepts of mathematics, language, science, and social studies to provide a sound foundation for more advanced study in the higher grades. They also try to instill in the students good study and work habits and an appreciation for learning while closely watching and evaluating each child's performance and potential.

Elementary school teachers often devise creative means to present a specific subject matter. They may use films, slides, computers, or develop instructional games. They also ar-

Most elementary school teachers instruct a single group of children in several subjects.

range class trips, speakers, and class projects. All of this work involves much time and effort, often after the regular school day is finished.

Teachers also are concerned with the social development and health of their students. They study each child's interactions with his or her classmates and discuss any problems with the parents. Teachers may, for example, meet with the parents of a child who habitually resists authority to discover the causes of these actions and work out a solution. Teachers also report any possible health problems to parents and school health officials. The teacher's primary concern is to insure that each child receives as much personalized help as required.

Most elementary school teachers instruct a single group of children in several subjects. In some schools, two teachers or more "team teach" and are jointly responsible for a group of students or for a particular subject. An increasing number of elementary school teachers specialize in one or two subjects and teach these subjects to several classes. Some teach special subjects such as music, art, or physical education, while others teach basic subjects such as English, mathematics, or social studies.

Teachers participate in many activities outside the classroom. They generally must attend regularly scheduled faculty meetings and may serve on faculty committees, such as those to revise curricula, or to evaluate the school's objectives and the student's performance. Teachers also may supervise after-school activities such as glee clubs, drama clubs, or arts and crafts classes. To stay up-to-date on educational materials and teaching techniques, they participate in workshops and other inservice activities, and take courses at local colleges and universities.

A growing number of elementary school teachers have aides to do secretarial work and help supervise lunch and playground activities. As a result, teachers can be free from routine duties to give more individual attention to students.

Places of Employment

About 1.4 million people worked as elementary school teachers in 1976. Most elementary teachers work in public schools that have six grades; however, some teach in middle schools—schools that cover the 3 or 4 years between the lower elementary grades and 4 years of high school. Only about 13 percent of elementary school teachers work in nonpublic schools.

A large proportion of all public elementary school teachers teach in urban areas, including cities and their suburbs.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia require public elementary school teachers to be certified by the department of education in the State in which they work. Some States also require teachers in private and parochial schools to be certified.

To qualify for certification, a teacher must have a bachelor's degree from an institution with an approved teacher education program. Besides a bachelor's degree, which provides the necessary liberal arts background, States require that prospective teachers have student-teaching and other education courses.

In 1976, 14 States required teachers to get supplementary postgraduate education—usually a master's degree or a fifth year of study—after their initial certification. Some States required U.S. citizenship; some an oath of allegiance; and several a health certificate.

Local school systems sometimes have additional requirements for employment. Students should write to the local superintendent of schools and to the State department of education for information on specific requirements in the area where they want to teach.

In addition to meeting educational and certification requirements, teachers should be creative, dependable, and patient. Most important, they should want to be directly involved in the educational and emotional development of children. Competence in handling classroom situations also is important.

As a teacher gains experience, he or she may advance within a school system or transfer to another which recognizes experience and has a higher salary scale. Some teachers may advance to supervisory, administrative, or specialized positions. Often, however, these positions require additional training and certification. As a result, for most teachers, advancement consists of higher pay rather than more responsibility or a higher position.

Employment Outlook

Kindergarten and elementary school teachers are expected to face competition for jobs of their choice through the mid-1980's. If patterns of entry and reentry to the profession continue in line with past trends, the

number of persons qualified to teach in elementary schools will exceed the number of openings.

The basic sources of teacher supply are recent college graduates qualified to teach at the elementary level and teachers seeking reentry to the profession. Reentrants, although more experienced, will face increasing competition from new graduates, who command lower salaries and have more recent training.

Pupil enrollment is the basic factor underlying the need for teachers. Because of fewer births in the 1960's, elementary enrollments have been on the decline since 1967, when they peaked at nearly 32 million. The National Center for Education Statistics projects that by 1982 the downward enrollment trend will halt at a level of 28 million, and enrollments again will advance to about 29 million by 1985.

Teachers will be needed to fill new positions created by larger enrollments; to replace those who are not now certified; to meet the expected pressure for an improved pupil-teacher ratio; and to fill positions vacated by teachers who retire, die, or leave the profession for other reasons.

However, a decline in the projected number of children born over the next decade could lessen the demand for teachers. While the trend has not been clearly established, since 1970 women have continued to have fewer children, and according to a recent survey, they expect to continue having smaller families than were common 10 years ago.

Several factors could alter the outlook for teachers. Increased emphasis on early childhood education, on special programs for disadvantaged children, and on individual instruction may result in larger enrollments, smaller student-teacher ratios, and consequently an increased need for teachers. Possible budget restraints for educational services, on the other hand, might limit expansion.

Earnings and Working Conditions

According to the National Education Association, public elementary school teachers averaged $11,870 a year in 1976. Average earnings in 1976 were more than one and one-third times as much as the average earnings for all nonsupervisory workers in private industry, except farming. Generally, States in the Northeast and in the West paid the highest salaries.

Collective bargaining agreements cover an increasingly large number of teachers. In 1976, 31 States had enacted laws that required collective bargaining in the teacher contract negotiation process. Most public school systems that enroll 1,000 students or more bargain with teacher organizations over wages, hours, and the terms and conditions of employment.

Public school systems enrolling 6,000 or more pupils paid teachers with a bachelor's degree average starting salaries of $8,233 a year in 1974-75. Those with a master's degree earned a starting average of $9,159 a year.

Public elementary school teachers worked an average of about 36-1/2 hours a week in 1976. Additional time spent preparing lessons, grading papers, making reports, attending meetings, and supervising extracurricular activities increased the total number of hours to about 46.

In addition to their regular teaching assignments, some elementary school teachers teach summer sessions, take courses, or work at other jobs, such as camp counselors. Most elementary school teachers work a traditional two-semester, 9-month school year. Some, however, work in year-round schools where they work an 8-week session, are off 1 week, and have a longer midwinter break. This type of schedule may make finding additional employment outside of the school system difficult.

Teachers spend much of their time walking, kneeling, or even sitting on the floor. For example, kindergarten teachers may join their students on the floor to finger paint, cut out pictures, or do other crafts.

Employment in teaching is steady, and business conditions usually do not affect the market for teachers. In 1976, 38 States and the District of Columbia had tenure laws that insured the jobs of teachers who had successfully taught for a certain number of years.

Sources of Additional Information

Information on schools and certification requirements is available from local school systems and State departments of education.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

Other sources of general information are:

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

SECONDARY SCHOOL TEACHERS

(D.O.T. 091.228)

Nature of the Work

The high school years are the years of transition from childhood to young adulthood. They are the years when students delve more deeply into subject matter introduced in elementary school and learn more about themselves and the world. It is also a time of preparation for their future lives as citizens and jobholders. Secondary school teachers have a direct role in this process.

The primary function of the secondary school teacher is to instruct students in a specific subject such as English, mathematics, social studies, or science. Within a teacher's specialized subject area, he or she may teach a variety of courses. A social studies teacher, for example may instruct two 9th grade classes in American History, two 12th grade classes in Contemporary American Problems, and another class in World Geography. For each class, the teacher develops lesson plans, prepares and gives examinations, and arranges other activities, such as a class project to devise an urban redevelopment plan for the city.

Teachers also must design their classroom presentations to meet the

Teachers must strive to create an atmosphere for learning.

individual needs and abilities of their students. They may arrange tutoring for students, or give advanced assignments for highly motivated pupils. Recognizing the needs of each student can be difficult because most teachers conduct five separate classes a day.

Teachers use a variety of instructional materials including films, slides, and computer terminals. They also may arrange for speakers or trips to supplement their classroom lectures such as a visit to the planetarium after a discussion on the earth's rotation.

Some teachers train students for specific jobs after graduation such as welding, automechanics, or distributive education. These teachers instruct with the actual tools of the trade whether they be adding machines or an 8-cylinder car engine.

Secondary school teachers also supervise study halls and homerooms, and attend meetings with parents and school personnel. Often they work with student groups outside of class to help solve specific problems. Teachers also participate in workshops and college classes to keep up-to-date on their subject specialty and on current trends in education.

In recent years, teachers have been able to spend more time teaching due to the increased availability of teacher aides who perform secretarial work, grade papers, and do other routine tasks.

Places of Employment

In 1976, more than 1 million teachers taught in secondary schools. More than 90 percent of them taught in public schools. Although they work in all parts of the country, teachers are concentrated in cities and in suburban areas.

According to a recent survey, slightly more than one-half of all public secondary teachers teach in senior high schools; about one-third teach at the junior high level. About one-tenth teach in junior-senior high schools, and a very small number are elementary-secondary combination teachers.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia require public secondary school teachers to be certified. Many States also require certification of secondary teachers in private and parochial schools.

The minimum educational requirement for certification is a bachelor's degree. In 1976, the District of Columbia was the only jurisdiction requiring a master's degree for initial certification as a senior high school teacher. Fourteen States, however, have specified that a secondary school teacher must get additional education, usually a fifth year of study or a master's degree, within a certain period after beginning employment. As a result, more and more secondary school teachers are obtaining advanced degrees.

The educational requirements for secondary school teachers vary by State and by school system. Approved colleges and universities in every State offer programs that include the education courses and the student-teaching that States require. They also offer the academic courses that are necessary to qualify teachers in the various subject specialties taught at the secondary level.

States and local jurisdictions often have general teacher requirements, such as the recommendation of the college, a certificate of health, and U.S. citizenship. Prospective teachers may get complete information on such educational and general requirements from each State department of education and from the superintendent of schools in each community.

Aside from educational requirements, a secondary school teacher must want to work with young people, have an interest in a special subject, and have the ability to motivate students and to relate knowledge to them.

Education and experience provide the primary basis for advancement, usually in the form of higher salaries rather than a different job. Advancement to supervisory and administrative positions usually requires at least 1 year of professional education beyond the bachelor's degree and several years of successful classroom teaching. Only a small proportion of secondary school teachers, however, advance to administrative positions.

Some experienced teachers with specific preparation may work as special school service personnel, such as school psychologists, reading specialists, or guidance counselors. Often these jobs require special certification as well as special education.

Employment Outlook

The supply of secondary school teachers through the mid-1980's will greatly exceed anticipated require-

ments if past trends of entry into the profession continue. As a result, prospective teachers are likely to face keen competition for jobs.

The prime sources of teacher supply are recent college graduates qualified to teach secondary school and teachers seeking to reenter the profession. Although reentrants have experience in their favor, many schools may prefer to hire new graduates who command lower salaries and whose training is more recent.

Pupil enrollment is the basic factor underlying the demand for teachers. The National Center for Education Statistics projects that enrollment in secondary schools will decline and, in turn, reduce the demand for teachers. As a result, over the 1976-85 period, nearly all teaching positions will stem from the need to replace teachers who die, retire, or leave the profession for other reasons. Thus, an increasing proportion of prospective teachers will have to consider alternatives to secondary school teaching.

Although the overall outlook for secondary teachers indicates a highly competitive market, employment conditions may be more favorable in certain fields. According to a recent survey, the supply of teachers of vocational subjects was not adequate to meet the demand. Mathematics, natural sciences, and physical sciences should not experience as large an oversupply as some other subjects.

Earnings and Working Conditions

According to the National Education Association, public secondary school teachers averaged $12,395 per year in 1976. This is 1 1/2 times the average for nonsupervisory workers in private industry, except farming. Generally, salaries were higher in the Northeast and in the West than they were in the Southeast and in the Middle States.

In school systems with enrollments of 6,000 or more, beginning teachers with a bachelor's degree earned average salaries of $8,233 in the school year 1974-75. New teachers with a master's degree started at $9,159 a year. Beginning teachers could expect regular salary increases as they gained experience and additional education.

A recent survey of public school teachers indicated that the average required school week for those in secondary schools was 37 hours. However, when all teaching duties, including meetings, lesson preparation, and other necessary tasks are taken into consideration, the total number of hours spent working each week was slightly more than 48.

In some schools, teachers receive supplementary pay for certain school-related activities such as coaching in sports and working with students in extracurricular activities, such as music, dramatics, or school publications. Some public school teachers also work in their school systems during the summer. Others hold summer jobs outside the school system.

While many teachers work the traditional 9-month school year with a 3-month summer vacation, some districts have converted to a year-round schedule. Teachers on this type of schedule may work 8 weeks, be on vacation for 1 week, and have a 5-week midwinter break. Laws in 38 States and the District of Columbia ensure the employment of those who have achieved tenure status. Laws requiring collective bargaining of wages, hours, and the terms and conditions of employment cover increasing numbers of teachers.

Sources of Additional Information

Information on schools and certification requirements is available from local school systems and State departments of education.

Information on the Teacher Corps, internships, graduate fellowships, and other information on teaching may be obtained from:

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COLLEGE AND UNIVERSITY TEACHERS

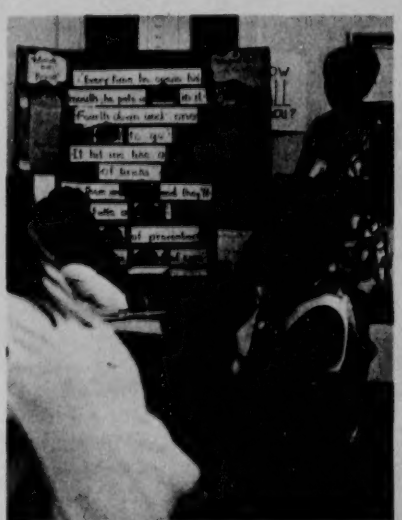
(D.O.T. 090.168 and .228)

Nature of the Work

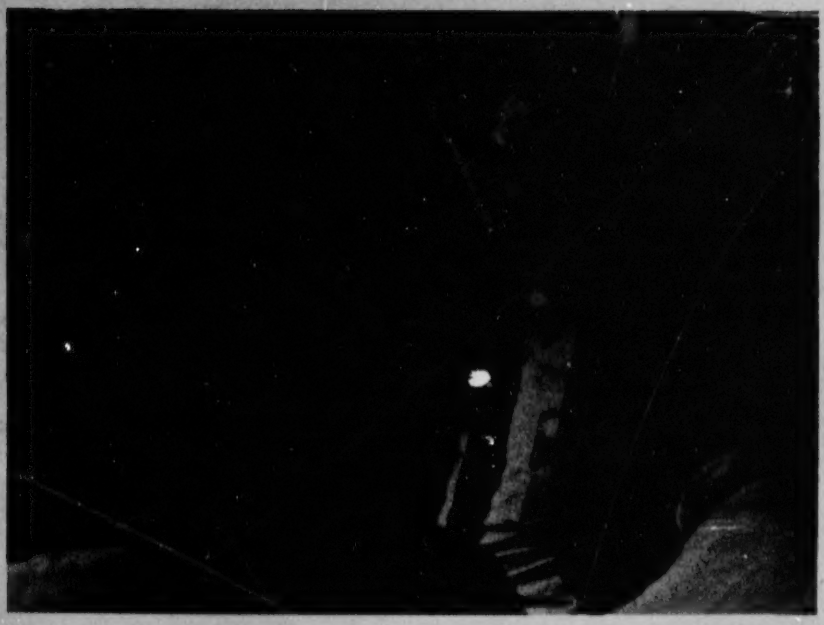
Each year thousands of Americans enter college. Some view college as a personal enrichment experience. Others seek higher education to obtain a lucrative and interesting job. Many persons attend college for a variety of reasons. To meet these diversified demands, colleges and universities hire well-educated teachers to provide instruction in various subjects.

The primary function of the college or university teacher is to present an in-depth analysis of a particular subject matter. Many teachers conduct a variety of courses such as a basic, freshman English composition course and an advanced poetry class for students majoring in English. Many instruct undergraduates only, while some instruct both undergraduates and graduate students. Still fewer instruct only graduate students. Usually, the more experienced and educated teachers conduct the higher level classes.

College and university teachers use various presentations in their classes, depending on the subject, interest, and level of their students.



Professor instructing teacher education class.



Many college teachers, in addition to teaching, participate in professional activities and conduct research.

Some conduct large lecture classes for basic courses while others lead advanced seminars with only a few students. Still others work primarily in laboratories for subjects such as biology, engineering, or chemistry. Some teachers have the aid of teaching assistants who usually are studying for advanced degrees. Closed-circuit television, tape recorders, and other machines frequently are used.

To be effective, college teachers must keep up with developments in their field by reading current material, participating in professional activities, and conducting research. Some publish books and articles. The importance of research and publication varies from one institutional level to another. For example, a recent survey indicated that more than one-third of the Ph. D. faculty in doctorate level science and engineering departments spent more than half of their time in research activities. Research usually is stressed more at 4-year colleges and universities than at junior and community colleges.

In addition to time spent on preparation, instruction, and evaluation, college and university teachers participate in faculty activities; work with student organizations and act as student advisors; work with the college administration; and in other ways serve the institution and the community. Those who are department heads have supervisory and administrative duties.

Places of Employment

In 1976, about 593,000 teachers worked in more than 3,000 colleges and universities. About 70 percent of them taught in public institutions. An estimated 441,000 were full-time senior staff; about 145,000 were part-time senior staff; and 7,000 were full-time junior instructors. In addition, there were thousands of part-time assistant instructors, teaching fellows, teaching assistants, or laboratory assistants who aided these teachers while studying for their advanced degrees.

Of full-time faculty, about one-third teach in universities; about two-fifths work in 4-year colleges; and about one-fifth teach in 2-year colleges. About two-thirds of the faculty in universities and 4-year colleges teach in public institutions; more than nine-tenths of the faculty in 2-year institutions work in public junior and community colleges.

Training, Other Qualifications, and Advancement

Most college and university faculty are classified in four academic ranks: instructors, assistant professors, associate professors, and full professors. About 75 percent of all faculty are assistant, associate, or full professors, with the three ranks equally distributed. Twenty percent are instructors.

Most inexperienced persons are hired as instructors and must have at least a master's degree. To advance to higher ranks, instructors need additional training plus experience. Assistant professors usually need a year of graduate study beyond the master's degree and at least a year or two of experience as an instructor. Appointments as associate professors frequently demand the doctoral degree and an additional 3 years or more of college teaching experience. For a full professorship, the doctorate, extensive teaching experience, and published articles and books usually are essential.

In addition to advanced study and college-level teaching experience, outstanding academic, administrative, and professional contributions influence advancement. Research, publication, and work experience in a subject area may hasten advancement.

Employment Outlook

College and university teaching candidates are expected to face keen competition through the mid-1980's. Although demand for these teachers is expected to increase, the number of master's and Ph. D. degree recipients is expected to greatly exceed all openings resulting from growth and separations from the profession. The number of Ph. D. recipients alone, in fact, is likely to exceed the expected number of openings. Therefore, an increasing proportion of prospective college teachers, especially those with only master's degrees, will have to seek nonacademic jobs. Government and private industry should provide some positions, but some persons holding graduate degrees may find it necessary to enter occupations that have not traditionally required advanced study.

Those seeking a teaching position will find the best opportunities at public colleges and universities.

The basic factor underlying the demand for teachers is college enrollment. During the 1960's and ear-

ly 1970's, teacher employment expanded due to growth in both the number of college-age persons and the proportion of 18- to 21-year-olds enrolled in college. Enrollments are expected to increase through the mid-1980's and then decline somewhat, but to a level higher than at present. As a result, the total number of teachers needed over the period is expected to rise.

The type and level of the institution and the extent to which it wishes to upgrade its faculty also will influence the demand for teachers. Although enrollments in the 1970's are expected to stabilize in 4-year colleges and universities, many institutions, including junior and community colleges, may want to hire additional Ph. D.'s to upgrade their faculties. This, coupled with an increasingly large supply of Ph. D.'s, will make it especially difficult for master's degree holders to find teaching positions in 4-year institutions.

Earnings and Working Conditions

Earnings varied widely according to faculty rank and type of institution. In general, teachers in public institutions (in both 2-year and 4-year schools) averaged higher salaries than teachers in private schools in 1975-76. Salaries ranged from an average minimum of $7,272 for instructors in private 2-year institutions, to an average maximum of $25,387 for professors at 4-year public institutions.

In 1975-76, about one-third of all institutions paid according to salary schedules by rank. On the average, more public than private institutions had these schedules. In institutions without schedules, a college senate often determined salaries according to a general set of criteria.

Since about 2 out of 3 college teachers have 9- to 10-month contracts, many have additional summer earnings from research, writing for publication, or other employment. Royalties and fees for speaking engagements may provide additional earnings. Some teachers also undertake additional teaching or research projects or work as consultants.

College and university teachers also may enjoy certain benefits, including tuition waivers for dependents, housing allowances, travel allowances, and paid leaves of absence. Colleges typically grant a semester's leave after 6 or 7 years of employment.

About 85 percent of all college and university teachers work in institutions that have tenure systems. Of the full-time teachers employed in these institutions, over one-half are tenured. Under a tenure system, a teacher usually receives 1-year contracts during a probationary period ranging from 3 to 7 years; some universities award 2- or 3-year contracts. After the probationary period, institutions consider teachers for tenure (the assurance of continuing employment with freedom from dismissal without cause).

Most teachers work in institutions run on a semester basis; others work in schools that are on trimesters with shorter breaks between each school session.

College teachers usually have flexible teaching schedules. According to a recent survey, the undergraduate faculty in 4-year colleges and universities normally teach 12 hours a week and seldom more than 14 or 15 hours. Graduate faculty have a teaching load of about 10 hours a week. In addition to time spent in the classroom, college and university teachers devote much time to preparation and other duties. Overall, full-time faculty spend about 55 hours a week on school-related activities. For faculty in junior and community colleges, the normal teaching load is slightly heavier, but the total number of hours on the job are fewer.

Sources of Additional Information

Information on college teaching as a career is available from:

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

American Council on Education, 1 Dupont Circle NW., Washington, D.C. 20036.

American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20065.

Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular fields. Names and addresses of societies are given in the statements on specific professions elsewhere in the *Handbook*.

TEACHER AIDES

Nature of the Work

Teacher aides free teachers of routine tasks that persons without extensive training in teaching can handle. They support teachers directly in work involved with teaching students and, indirectly, in nonteaching activities. Aides may work in the classroom under the teacher's supervision or have duties assigned outside the learning environment.

Aides' responsibilities vary greatly by school district. In some areas, aides work directly in the instruction of children. Under the supervision and guidance of the teacher, they help students individually or in small groups. An aide might listen to one student read, for example, or help another find information needed for a report, or watch as a third practices or demonstrates a skill. Sometimes the teacher has an aide take charge of a special project for a group of students, such as preparing equipment for a science demonstration.

In other areas, teacher aides primarily handle many of the routine tasks that otherwise would be left to the teacher. They may grade tests and papers, check homework, and keep health and attendance records. Also, secretarial duties such as typing, filing, and duplicating materials for the teacher's use may be part of the aide's job. Sometimes the duties of teacher aides include stocking supplies, preparing materials for use by students, and operating audiovisual equipment. They also may supervise students during lunch and recreation periods and school bus loading and help keep the classroom in order.

Some aides work directly in the instruction of children.

Places of Employment

In 1976, about 320,000 persons worked as teacher aides. While aides work in both elementary and secondary schools, they are concentrated in the early grades. Large city schools or schools in metropolitan areas surrounding large cities employ a large proportion of aides. Schools with large enrollments are more likely than small schools to employ teacher aides, and they more often hire them on a full-time, regular basis.

Training, Other Qualifications, and Advancement

Training requirements for teacher aides vary widely. Some schools hire beginning aides with a high school diploma; some do not require even a high school education. Other employers may want aides to have some college training or a bachelor's degree. Areas that delegate a significant amount of classroom responsibility to aides usually require more training than those districts which primarily assign aides to clerical or monitor jobs.

Teacher aides may receive their training for classroom work in a preservice program or on the job. A growing number of junior and community colleges offer teacher aide programs. Upon completion of one of these programs, the student is awarded an associate degree and is prepared to work directly in the classroom. In 1976, there were about 270 such programs.

In training programs, teacher aides learn how to help the classroom teacher work with students. Aides are taught to operate audiovisual equipment, administer first aid, and handle recordkeeping activities. They also learn to make charts and other instructional materials and practice techniques for making bulletin boards and working with other art media. In addition, teacher aides are made familiar with the organization and operation of a school, and they learn about the methods used to teach handwriting, reading, math, science, and other school subjects.

Personal traits are among the most important qualifying factors for the teacher aide's job. Aides should be able to work with children and to handle classroom situations with fairness and patience. Preference may be given in hiring to those with previous experience working with children. Aides also must demonstrate initiative and a willingness to follow the classroom teacher's directions. They must have basic speech and writing skills and be able to communicate effectively with students and teachers. Clerical skills may be necessary also.

Some schools have certain regulations regarding the hiring of teacher aides. Applicants may be required to have a family income below a certain level or to be parents of children in the school district. Sometimes persons living in the school community are given preference in hiring. In addition, health regulations may require that teacher aides pass a physical examination. Eight States (Alabama, Delaware, Georgia, New Mexico, New York, Ohio, Vermont, and Wisconsin) have established criteria for teacher aide employment that require aides to have permits or certificates. Thirty-eight States have issued general guidelines for hiring aides. In other areas, the city or county board of education may set standards for employment of aides. The local superintendent of schools and the State department of education can provide information on specific requirements for employment in a particular area.

Advancement for teacher aides, usually in the form of higher earnings or increased responsibility, comes primarily with experience. Some school districts provide release time so that aides may take courses. In this

way, aides eventually can earn bachelor's degrees and become certified teachers.

Employment Outlook

Employment of teacher aides is expected to rise much faster than the average for all occupations through the mid-1980's. If past trends continue, the proportion of teacher aides in relation to teachers being hired is expected to increase. Actual job prospects, however, will vary by district. Budget constraints may adversely affect demand for these workers in some areas, while other districts, unable to afford additional more highly paid teachers, may hire aides to lessen teachers' clerical duties. In addition, more aides will be needed to fill openings as workers die, retire, or transfer to other occupations.

Earnings and Working Conditions

According to the limited information available, salaries of teacher aides ranged from $2 to over $5 an hour in 1975. Earnings varied by region and also by the work experience and academic qualifications of the aide. Most aides, usually those covered by collective bargaining agreements, have health and welfare benefits similar to those of the teachers in their schools.

Teacher aides may work full time or part time. They may work inside or outdoors and may spend much of their time standing, walking, or kneeling.

Sources of Additional Information

Information on junior college 1- and 2-year programs for teacher aides is available from:

The American Association of Junior Colleges, One Dupont Circle NW., Washington, D.C. 20036.

Additional information on the occupation may be obtained from:

National Education Association, 1201 16th St. NW., Washington, D.C. 20036.

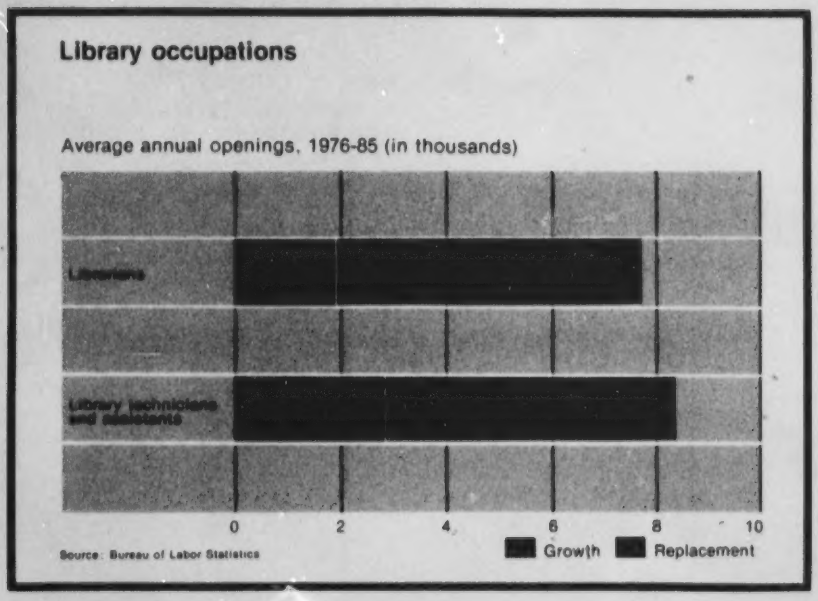
American Federation of Teachers, 1012 14th St. NW., Washington, D.C. 20005.

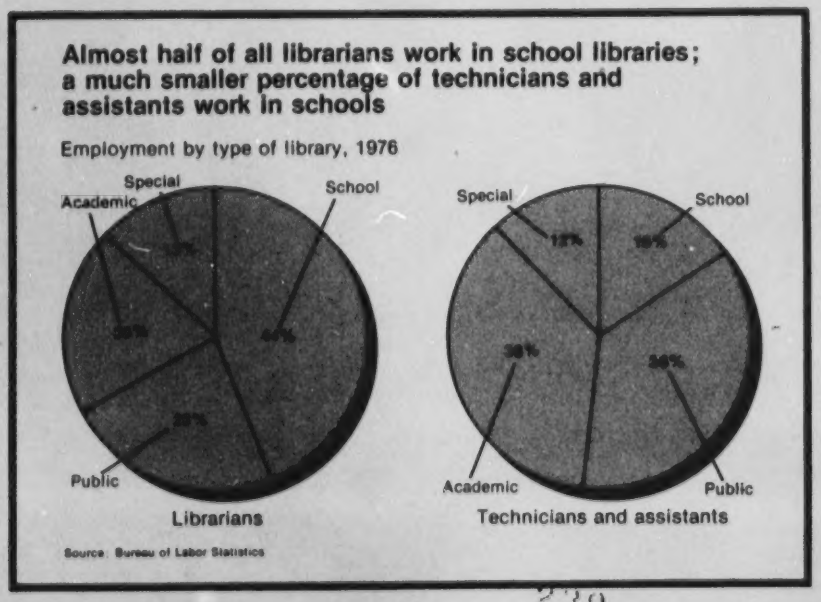
LIBRARY OCCUPATIONS

Before the written language was developed, people passed on information through the spoken word. Each generation told the next what they had learned about the world, the family, and the skills needed for survival. Often, however, details could be lost or changed substantially through the ages.

As the years passed, people learned to express their ideas in drawings and then in a written manner. Alphabets came into existence. People no longer relied on their memories for information—they could seek out what they needed to know in scrolls or books. Today, we can research what occurred centuries ago, or read of the accomplishments of modern scientists simply by giving to one source—the library.

Libraries are storehouses of information containing the history of the universe. But they also can be confusing places containing many large rooms filled with stacks of books. Librarians and library technicians and assistants help us find the information we want. They provide us with access to books, periodicals, and other printed materials, as well as less conventional forms of information such as microfilms, slides, and computer tapes. The following statements describe their work in more detail.





LIBRARIANS

(D.O.T. 100.118 through .388)

Nature of the Work

Librarians make information available to people. They serve as a link between the public and the millions of sources of information by selecting and organizing materials, making them accessible, and assisting in their use.

Library work is divided into two areas: user services and technical services. Librarians in user services—for example, reference and children's librarians—work directly with the public helping them find the information they need. Librarians in technical services—such as acquisition librarians—are primarily concerned with preparing materials for use and do not frequently deal with the public. They order, classify, and catalog all types of materials.

The size of the library usually determines the scope of a librarian's

job. In small libraries, the job may include both user and technical services. The librarian may select and organize materials, publicize services, do research, and give reference help to groups and individuals. In large libraries, librarians usually specialize in either user or technical services and specialize further in certain subject areas, such as science, business, the arts, or medicine. A librarian in technical services who specializes in engineering, for example, may review books or write summaries of articles on new engineering developments.

Regardless of the nature of their work, librarians generally are classified according to the type of library in which they work: public libraries, school media centers, college and university libraries, and special libraries.

Public librarians serve all kinds of people—children, students, research workers, teachers, and others. Increasingly, public librarians provide special materials and services to culturally and educationally deprived persons, and to persons who, because of physical handicaps, cannot use conventional print.

The professional staff of a large public library system may include the chief librarian, an assistant chief, and several division heads who plan and coordinate the work of the entire library system. The system also may include librarians who supervise branch libraries and specialists in certain areas of library work. The duties of some of these specialists are described briefly in the following paragraphs.

Acquisition librarians purchase books and other materials to maintain a well-balanced library that meets the needs and interests of the public. *Catalogers* classify these materials by subject and otherwise describe them to help users find what they are looking for. *Reference librarians* answer specific questions and suggest sources of information.

Some librarians work with specific groups of readers. *Children's librarians* serve the special needs of young people by finding books they will enjoy and showing them how to use the library. They may plan and conduct special programs such as story hours or film programs. Their work in serving children often includes working with school and community organizations. *Adult services librarians* suggest materials suited to the needs and interests of adults. They may cooperate in planning and conducting education programs, such as community development, public affairs, creative arts, problems of the aging, and home and family. *Young adult services librarians* help junior and senior high school students select and use books and other materials. They may organize programs of interest to young adults, such as book or film discussions or concerts of recorded music. They also may coordinate the library's work with school programs. *Extension or outreach librarians working in bookmobiles* offer library services to people not adequately served by a public library such as those in inner city neighborhoods, migrant camps, rural communities, and institutions, including hospitals and homes for the aged.

School librarians instruct students in the use of the school library and help them choose from the media center's collection of print and nonprint materials items that are related to their interests and to classroom subjects. Working with teachers and supervisors, school librarians familiarize students with the library's resources. They prepare lists of materials on certain subjects and help select materials for school programs. They also select, order, and organize the library's materials. Increasingly, the school library is viewed as part of the entire instructional system rather than a resource that students use 1 or 2 hours a week. As a result, the scope of the duties of many school librarians' has widened. In some schools, librarians work with teachers to develop units of study or independent study programs, and also may participate in team teaching.

Very large high schools may employ several school librarians, each responsible for a particular function

School librarian showing students how to use the library.

of the library program or for a special subject area. *Media specialists*, for example, develop audio-visual programs to be included in or to supplement the curriculum. They also may develop materials and work with teachers on curriculum.

College and university librarians serve students, faculty members, and research workers in institutions of higher education. They may provide general reference service or may work in a particular subject field, such as law, medicine, economics, or music. Those working on university research projects operate documentation centers that use computers to record, store, and retrieve specialized information. College and university librarians may teach classes in the use of the library.

Special librarians work in libraries maintained by government agencies and by commercial and industrial firms, such as pharmaceutical companies, banks, advertising agencies, and research laboratories. They provide materials and services covering subjects of special interest to the organization. They build and arrange the organization's information resources to suit the needs of the library users. Special librarians assist users and may conduct literature searches, compile bibliographies, and in other ways provide information on a particular subject.

Others called *information science specialists*, like special librarians, work in technical libraries or information centers of commercial and industrial firms, government agencies, and research centers. Although they perform many duties of special librarians, they must possess a more extensive technical and scientific background and a knowledge of new techniques for handling information. Information science specialists abstract complicated information into condensed, readable form, and interpret and analyze data for a highly specialized clientele. Among other duties, they develop classification systems, prepare coding and programming techniques for computerized information storage and retrieval systems, design information networks, and develop microfilm technology.

Information on library technicians and assistants is found in a separate statement in the *Handbook*.

Places of Employment

An estimated 128,000 professional librarians were employed in 1976. School librarians accounted for more than two-fifths of the total, and public libraries and colleges and universities each employed about one-fifth. The remainder worked in special libraries, including those in government agencies, or in institutions such as correctional facilities and hospitals. A small number served as consultants, as State and Federal Government administrators, and as faculty in schools of library science. In late 1975, the Federal Government employed about 3,300 professional librarians.

Most librarians work in cities and towns. Those attached to bookmobile units serve widely scattered population groups.

Training, Other Qualifications, and Advancement

A professional librarian ordinarily must complete a 1-year master's degree program in library science. A Ph. D. degree is an advantage to those who plan a teaching career in library schools or who aspire to a top administrative post, particularly in a college or university library or in a large library system. For those who are interested in the special libraries field, a master's degree or doctorate in the subject of the library's specialization is highly desirable.

In 1976, 58 library schools in the United States were accredited by the American Library Association and offered a master's degree in library science (M.L.S.). In addition, many other colleges offer graduate programs or courses within 4-year undergraduate programs.

Most graduate schools of library science require graduation from an accredited 4-year college or university, a good undergraduate record, and a reading knowledge of at least one foreign language. Some schools also require introductory undergraduate courses in library science. Most prefer a liberal arts background with a major in an area such as the social sciences, the arts, or literature. Some schools require entrance examinations.

Library science students usually specialize in the area in which they plan to work. An aspiring information science specialist, for example, takes courses on data processing fundamentals and computer languages in addition to the required library science courses. A student wishing to become a media specialist concentrates on courses in the use and development of audio-visual materials. Special librarians and information science specialists must have extensive knowledge of their subject matter as well as training in library science. They usually earn a bachelor's or higher degree in chemistry, for example, plus a master's or Ph. D. in library or information science.

Most States require that public school librarians be certified and trained both as teachers and librarians. They also may require that media specialists, for example, have specialized in media within the M.L.S. program. Some States require certification of public librarians employed in areas such as municipal, county, or regional library systems. The specific education and experience necessary for certification vary according to State and the school district. The local superintendent of schools and the State department of education can provide information about specific requirements in an area.

In the Federal Government, beginning positions require completion of a 4-year college course and a master's degree in library science, or demonstration of the equivalent in experience and education by a passing grade on an examination.

Many students attend library schools under cooperative work-study programs that combine the academic program with practical work experience in a library. Scholarships for training in library science are available under certain State and Federal programs and from library schools, as well as from a number of the large libraries and library associations. Loans, assistantships, and financial aid also are available.

Experienced librarians may advance to administrative positions or to specialized work. Promotion to

these positions, however, is limited primarily to those who have completed graduate training in a library school, or to those who have specialized training.

Employment Outlook

The employment outlook for librarians is expected to be somewhat competitive through the mid-1980's. Although employment in the field is expected to grow over the period, the supply of persons qualified for librarianship is likely to expand as an increasing number of new graduates and labor force reentrants seek jobs as librarians.

Employment prospects are expected to be best in public libraries. The growth of a better educated population coupled with greater emphasis on adult and community education programs will require additional librarians. The educationally disadvantaged, the handicapped, and various minority groups also will need qualified librarians to provide special services. Also, the expanding use of computers to store and retrieve information will contribute to the increased demand for information specialists and library automation specialists in all types of libraries.

The demand for school librarians on the other hand, will not increase significantly. Enrollments in higher education, however, are expected to rise until the mid-1980's, resulting in a greater number of librarians in post-high school institutions.

In addition to openings from growth, replacements will be needed each year for librarians who retire, die, transfer to other types of work, or leave the labor force.

Employment opportunities will vary not only by type of library but also by the librarian's educational qualifications and area of specialization. Although the overall employment outlook is competitive, persons who are willing to work in libraries located away from the large East or West Coast cities will have better opportunities. New graduates having more recent training may have an employment advantage over reentrants, delayed entrants, or those who transfer into the profession. This is especially true for those wanting positions as information specialists where knowledge of the latest computer technologies is important. New graduates usually command lower beginning salaries, compared to more experienced workers, and this also may be an employment advantage.

Earnings and Working Conditions

Salaries of librarians vary by type of library, the individual's qualifications, and the size and geographical location of the library.

Starting salaries of graduates of library school master's degree programs accredited by the American Library Association average $10,594 a year in 1975, ranging from $9,692 in public libraries to $10,900 in school libraries. Average salaries for librarians in college and university libraries ranged from $11,400 a year for those with less than 5 years of experience to over $20,000 for directors of libraries. In general, librarians earned about 1 1/2 times as much as the average for all nonsupervisory workers in private industry, except farming.

In the Federal Government, the entrance salary for librarians with a master's degree in library science was $14,097 a year in 1977. The average salary for all librarians in the Federal Government was about $20,000.

The typical workweek for librarians is 5 days, ranging from 35 to 40 hours. The work schedule of public and college librarians may include some weekend and evening work. School librarians generally have the same workday schedule as classroom teachers. A 40-hour week during normal business hours is common for government and other special librarians.

The usual paid vacation after a year's service is 3 to 4 weeks. Vacations may be longer in school libraries, and somewhat shorter in those operated by business and industry. Many librarians are covered by sick leave; life, health, and accident insurance; and pension plans.

Sources of Additional Information

Additional information, particularly on accredited programs and scholarships or loans, may be obtained from:

American Library Association, 50 East Huron St., Chicago, Ill. 60611.

For information on requirements for special librarians, write to:

Special Libraries Association, 235 Park Ave., South, New York, N.Y. 10003.

Information on Federal assistance for graduate school library training under the Higher Education Act of 1965 is available from:

Office of Libraries and Learning Resources, Office of Education, U.S. Department of Health, Education, and Welfare, Washington, D.C. 20202.

Those interested in a career in Federal libraries should write to:

Secretariat, Federal Library Committee, Room 310, Library of Congress, Washington, D.C. 20540.

Material on information science specialists may be obtained from:

American Society for Information Science, 1140 Connecticut Ave. NW., Washington, D.C. 20036.

Individual State library agencies can furnish information on scholarships available through their offices, on requirements for certification, and general information about career prospects in their regions. State boards of education can furnish information on certification requirements and job opportunities for school librarians.

LIBRARY TECHNICIANS AND ASSISTANTS

(D.O.T. 249.368)

Nature of the Work

Each year thousands of additional pieces of information become available to libraries. With each scientific advance, for example, many reports and evaluations are written. Professionals in various fields continually conduct research, whether on improved methods to grow house plants or on American foreign policy. The

sheer volume of these materials, coupled with an increasing number of library services, has created a need for library technicians and assistants to support librarians in providing information.

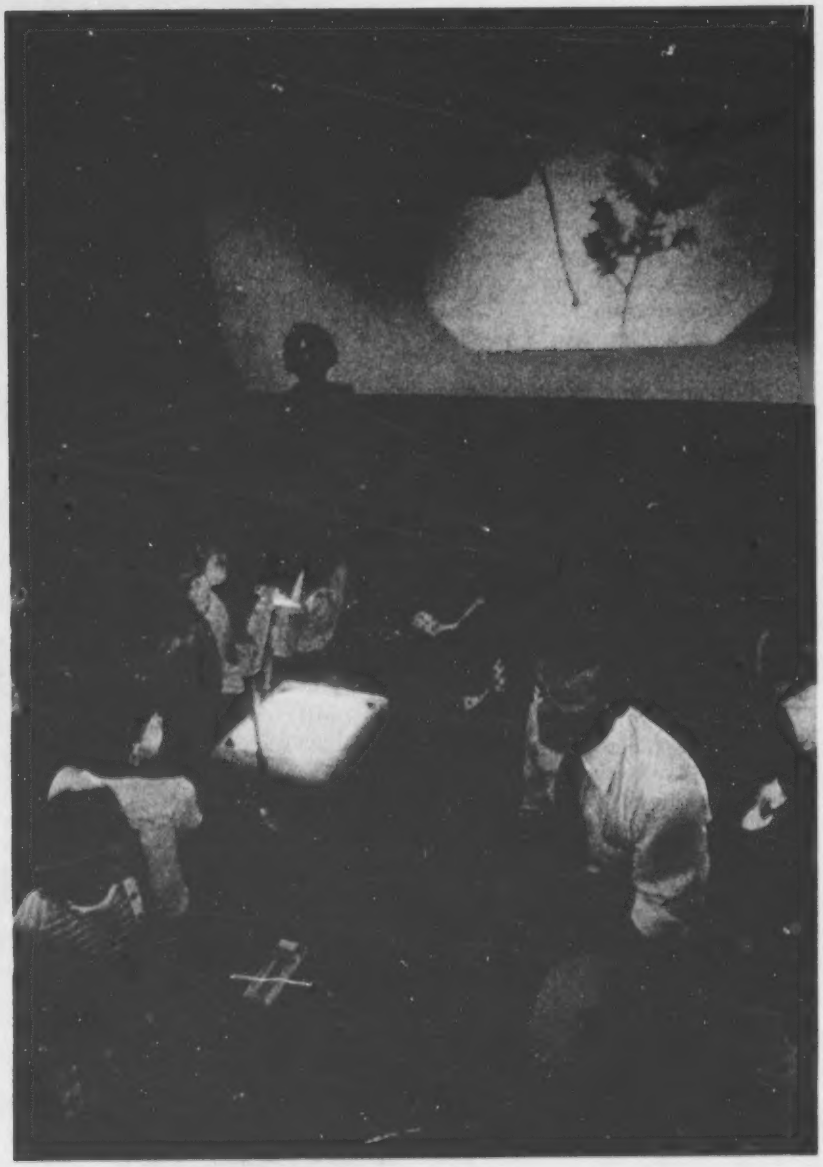
Library technicians and assistants work either in technical services or user services. Technicians, however, usually need more training than library assistants, sometimes called library clerks or pages, because their duties are more complicated and less clerical in nature.

In technical services, assistants and technicians prepare the library's materials and equipment for readers' use. Assistants may keep current files of special materials, such as newspaper clippings and pictures. They also may perform many of the routine tasks involved in purchasing and processing library materials, and sorting and shelving books.

Technicians often operate and maintain audiovisual and data processing equipment, such as projectors, tape recorders, and readers that magnify and project information on a screen. They also may catalog materials and make claims for items that are missing. Technicians sometimes work on special projects. A technician with artistic ability, for example, may design posters and displays for a school safety campaign.

In user services, library assistants and technicians furnish information on library services and answer questions that involve simple factfinding in standard reference sources. They also assist readers in the use of catalogs and indexes to locate books and other materials and may check out, reserve, and receive materials.

Technicians also may help librarians present programs to the community, school, or persons interested in a specific subject area. The technician may run a projector and pass out materials in a program on lawn care, for example.



Library technicians and assistants may operate and maintain audiovisual equipment.

Places of Employment

An estimated 143,000 people worked as library technicians and assistants in 1976. Most worked in large school and public libraries. Smaller numbers worked in college and university libraries and in medical, law, scientific, technical, and other special libraries.

In late 1975, the Federal Government employed about 3,600 library technicians. These people worked chiefly in the Department of Defense and the Library of Congress, although some worked in small Federal libraries throughout the country.

Training, Other Qualifications, and Advancement

Library technicians and assistants may receive training either on the job or in a formal post-high school program. Some libraries require only a high school education for library clerks, who, after a few years of training on the job, may advance to technicians. Other libraries hire only technicians who have formal technical training.

In 1976, 120 institutions, mostly 2-year colleges, offered library technical assistant training. Junior and community college programs generally lead to an associate of arts degree in library technology and in-

clude 1 year of liberal arts courses and a year of library-related study. Students study the purposes and organization of libraries, and the procedures and processes involved in their operation. They learn to order and process, catalog, and circulate library materials. Some receive training in data processing as it applies to libraries. Many learn to use and maintain audiovisual materials and equipment.

Some programs teach skills for a particular type of library or a specific skill such as audiovisual technology. Therefore, a prospective student should select a program with a knowledge of the curriculum, instructional facilities, faculty qualifications, and the kinds of jobs that graduates have found. Also, applicants should be aware that, while programs may lead to an associate degree, credits earned in a library technology program apply toward a professional degree in library science.

A high school diploma or its equivalent is the standard requirment for both academic and on-the-job training programs. Many programs also require typing.

Library technicians and assistants should enjoy working with books, numbers, and people. At times their jobs may be very repetitive, when calculating circulation statistics, for example. At other times, however, they may work on various special projects such as setting up displays. Physically, the job may require much standing, stooping, bending, and reaching.

Employment Outlook

The number of library technicians and assistants is expected to grow faster than the average for all occupations through the mid-1980's. The expansion of library services and the growth in population and school and college enrollments will be the main factors affecting demand for library assistants and technicians. In addition, technicians and assistants will increasingly perform some of the routine tasks formerly done by librarians.

In addition to openings created by growth, many library technicians and assistants will be needed annually to replace those who die, retire, or transfer to other fields.

Earnings and Working Conditions

Salaries for library technicians and assistants vary widely depending on the size of the library or library system in which they work as well as the geographical location and size of the community. However, in general, they averaged about the same as all nonsupervisory workers in private industry, except farming.

Salaries of library technicians in the Federal Government, averaged $11,000 in 1976.

Library technicians and assistants in government and special libraries usually work a regular 40-hour week, but those in public libraries and college and university libraries may have schedules that include weekend and evening hours. In schools, library technicians and assistants work during regular school hours.

Most libraries provide fringe benefits such as group insurance and retirement pay. Additional benefits offered by private businesses often include educational assistance programs. Library technicians employed by the Federal Government receive the same benefits as other Federal workers.

Sources of Additional Information

For information on institutions offering programs for the training of library technicians, write:

Council on Library Technical-Assistants, School Management Institute, 750 Brooksedge Blvd., Westerville, Ohio 43081.

American Library Association, Office of Library Personnel Resources, 50 East Huron St., Chicago, Ill. 60611.

SALES OCCUPATIONS

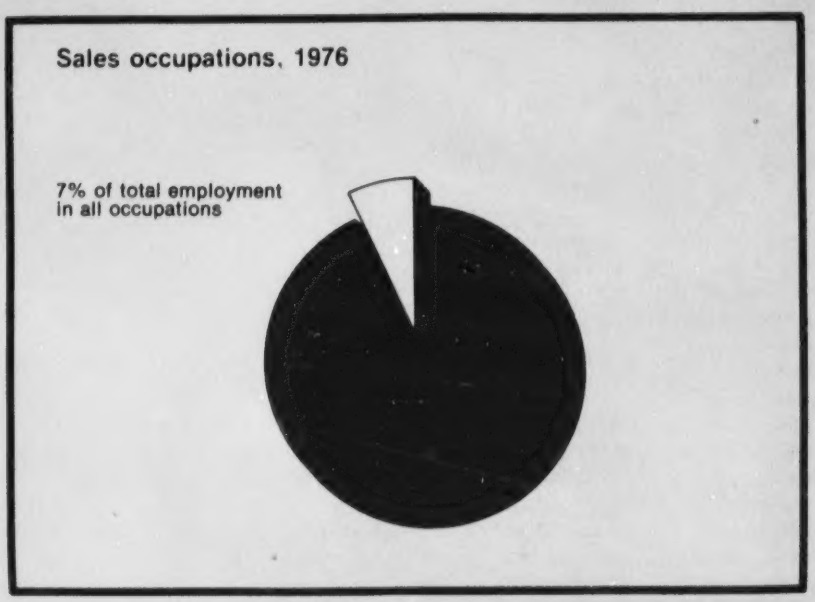
Sales work offers career opportunities for people who have completed high school as well as for college graduates, for those who want to travel and those who do not, and for salaried workers as well as for men and women who wish to run their own businesses.

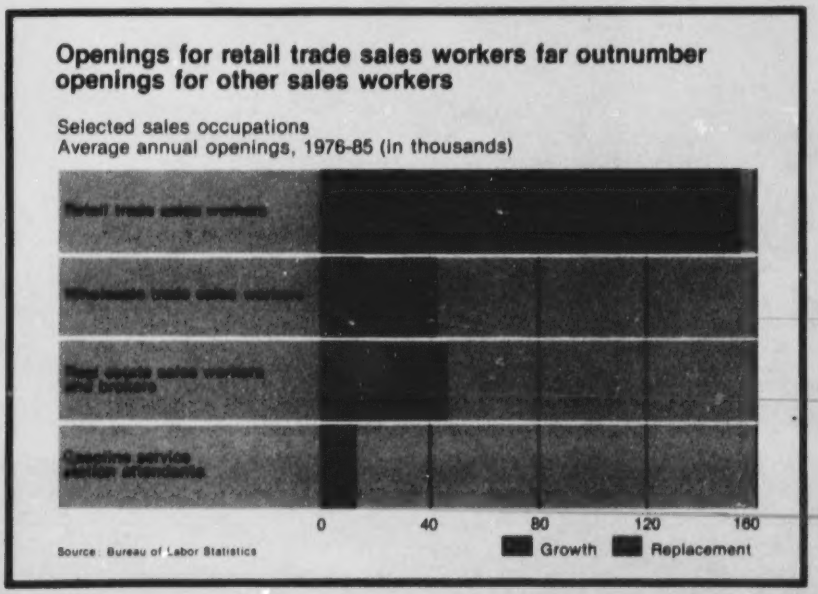
Workers in these jobs may sell for manufacturers, service firms, wholesalers, or retailers. In 1976, almost 5.5 million people, or about 7 percent of all workers, were in sales occupations; more than 25 percent worked part time. The sales occupations discussed in this section include sales workers in retail trade, wholesale trade, and manufacturing; insurance agents and brokers; real estate agents and brokers; and securities sales workers. Other statements in this section cover automotive sales workers, automobile parts counter workers, automobile service advisors, gasoline service attendants, models, and route drivers.

Training, Other Qualifications, and Advancement

Training requirements for sales work are as varied as the work itself. Sales workers who sell standardized merchandise such as magazines, candy, cigarettes, and cosmetics usually are trained on the job by experienced sales clerks; in some large stores, they may attend brief training courses. The sales worker who sells complex products or services, such as electronic equipment or liability insurance, needs a substantial amount of education and training. For some positions, sales workers must be college graduates with majors in a field such as engineering. Others get the necessary technical knowledge from university or manufacturers' courses. Still others learn through years of on-the-job experience, often supplemented by home study. Thus, a real estate agent may take university extension courses; a department store beauty counselor may participate in an industry-sponsored training program; or a jewelry sales worker may learn through years of observation and study on the job.

Even in the most routine kinds of selling, a high school diploma is an





asset to a beginner. Courses in business, as well as specialized courses in distributive education (marketing and merchandising), are particularly good preparation. Many high schools have distributive education programs that allow students to work part time in local businesses while attending classes in retailing.

Sales workers must understand the needs and viewpoints of their customers and be poised and at ease with strangers. Other important attributes for selling are energy, self-confidence, imagination, self-discipline, and the ability to communicate. Arithmetic skills are an asset. In almost all sales work except retail trade, sales workers need initiative to locate prospective customers and to plan work schedules.

Employment Outlook

Employment in sales occupations is expected to rise about as fast as the average for all occupations through the mid-1980's. In addition to jobs resulting from growth, thousands of openings will occur each year as workers die, retire, or leave the occupation for other reasons. As the accompanying chart indicates, the greatest number of openings are expected in retail trade sales positions. Many openings are also expected for wholesale trade sales workers and real estate agents. In addition, many part-time jobs will be available in suburban shopping centers which have retail stores open several nights a week.

Further information about employment prospects for sales workers is given in statements that follow.

AUTOMOBILE PARTS COUNTER WORKERS

(D.O.T. 289.358)

Nature of the Work

Automobile parts counter workers sell replacement parts and accessories for cars, vans, trucks, and other motor vehicles. Those who work in wholesale parts stores sell parts that can be used on many makes and models of vehicles. Their customers include independent repair shops, service stations, self-employed mechanics, and "do-it-yourselfers." Counter workers employed in dealerships usually sell only parts that are made for the makes of vehicles sold by the dealers they work for and spend most of their time supplying parts to the mechanics who work in the dealers' repair shops.

Because of the wide variety of cars and trucks on the road and the growing complexity of automobiles, parts stores must stock thousands of parts ranging from carburetors to rear view mirrors. Parts counter workers must be able to quickly identify and locate any of these parts for their customers, even when customers provide only a general description of the items they want. In order to determine what their customers need, counter workers must have a good knowledge of parts catalogs. In addition, to locate the parts quickly they must be familiar with the layout of the stockroom. If a customer needs a part that is not stocked, counter workers may suggest that they use knowledge of parts catalogs. In addition, to locate the parts quickly they must be familiar with the layout of the stockroom. If a customer needs a part that is not stocked, counter workers may suggest that they use one that is interchangeable, place a special order for the part with the manufacturer, or refer the customer to another dealer or store.

Once they have obtained the parts the customers want, counter workers use price lists to determine the costs of the parts. They then fill out sales receipts and collect from their customers. When necessary they package items sold.

In addition to selling, counter workers keep parts catalogs and price lists up to date, replenish stock, and unpack incoming shipments. They also take care of the paperwork involved in selling, such as recording sales, taking inventories, and ordering parts from manufacturers. In large firms, stock and receiving clerks do some of this work.

When counter workers do not have in stock the specific part a customer wants, they may use measuring devices, such as micrometers or calipers, to see if a part that is in stock would fit the customer's needs. Sometimes customers are not sure what is wrong with their car or which parts need to be replaced. On these

In large firms, computers are used to maintain inventory, order parts, and keep price lists up to date.

occasions, counter workers may use coil condenser testers, spark plug testers, and other equipment to identify defective parts. In some firms, particularly small wholesale stores, counter workers repair parts. For example, instead of replacing brakes they may repair them using equipment such as brake riveting machines and brake drum lathes.

Places of Employment

About 75,000 persons worked as automobile parts counter workers in 1976. Automobile dealers and parts wholesalers employed most of them. Dealers typically employed one to four counter workers; many wholesalers employed more than four. Other employers include truck dealers, retail automobile parts stores, and warehouse distributors of automotive parts. Trucking companies and buslines employ counter workers to maintain their stockrooms and dispense parts to mechanics who repair their fleets; however, these workers usually do not sell parts to customers.

Because dealerships and automobile parts stores are located throughout the country, parts counter workers are employed in almost every town and city. Those who work for warehouse distributors, trucking companies, and buslines are employed mainly in large cities.

Training, Other Qualifications and Advancement

Most parts counter workers learn the trade on the job. Beginners usually start as parts deliverers or trainees. In some large firms, beginners work as stock or receiving clerks. (See statements on stock clerks and receiving clerks elsewhere in the *Handbook*.) By filling out order forms and restocking shelves, trainees gradually familiarize themselves with the different types of parts, the use of catalogs and price lists, and the layout of the stockroom. Although trainees may wait on customers after a few months' experience, it generally takes about 2 years for a counter worker to become capable of handling every aspect of the job.

Automobile parts counter workers should have a good knowledge of how motor vehicles work and the functions of vehicle parts. The ability to work with numbers also is important. Employers generally prefer high school graduates for entry jobs. Courses in automobile mechanics, commercial arithmetic, merchandising, selling, and bookkeeping are helpful to young persons interested in becoming parts counter workers. Practical experience from working in a gasoline service station or automobile repair shop, or working on cars as a hobby also is helpful.

Since they deal with the public in many cases, persons considering careers as automobile parts counter workers should be neat, friendly, and tactful. A good memory and the ability to write legibly and concentrate on details also are important.

Counter workers with supervisory and business management ability may become parts department managers or store managers. Others who are especially good at dealing with people may become outside sales representatives for parts wholesalers and distributor These people sell parts to automobile repair shops, service stations, trucking companies, and other businesses that buy parts and accessories in large quantities. Some counter workers open their own automobile parts stores.

Employment Outlook

Employment of automobile parts counter workers is expected to increase faster than the average for all occupations. The number of vehicles in use will increase as population grows and incomes rise, allowing people to own more than one vehicle. Changes in styling and engineering of new cars and trucks will create more demand for new accessories and replacement parts. Also, as cars become more expensive, people may attempt to keep their cars longer, and create additional demand for replacement parts.

Besides jobs from employment growth, many openings are expected to be created annually because of the need to replace experienced workers who retire, die, or transfer to other occupations. The number of openings due to growth is not expected to fluctuate significantly from year to year because the demand for automobile parts, unlike some products, is not very sensitive to changing economic conditions.

Earnings and Working Conditions

Automobile parts counter workers are paid a weekly or monthly salary, or an hourly wage rate. In addition, they may receive commissions on sales. Counter workers employed by automobile dealers in 36 large cities had estimated average earnings of $5.08 an hour in 1976, slightly higher than the average for all nonsupervisory workers in private industry, except farming.

Parts counter workers typically work 40 to 48 hours a week. Because many customers find it convenient to shop on weekends, many counter workers work half a day on Saturday.

Stockrooms usually are clean and well lighted. The work is not physically strenuous, but counter workers spend much time standing or walking. They have to work rapidly, and often must wait on customers and answer telephone calls at the same time.

Many parts counter workers are members of the following unions: the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Details about employment opportunities may be obtained from local automobile dealers and parts wholesalers, locals of the unions previously mentioned, or the local office of the State employment service.

For general information about the occupation, write to:

Automotive Service Industry Association, 230 N. Michigan Ave., Chicago, Ill. 60601.

National Automotive Parts Association, 10400 West Higgins Rd., Rosemont, Ill. 60018.

AUTOMOBILE SALES WORKERS

(D.O.T. 280.358)

Nature of the Work

Automobile sales workers are important links between dealers and car buyers. Most specialize in selling either new or used cars. Others, particularly those employed in small dealerships, sell both.

Automobile sales workers spend much of their time waiting on customers in the showroom or used-car lot. When a customer enters the showroom, they try to find out what kind of car the customer wants by asking questions and encouraging the customer to talk about cars on display. For example, they may ask if the customer is interested primarily in economy, or in a high-performance automobile. Sales workers emphasize the points that please their customers in an effort to stimulate their willingness to buy. To demonstrate features, such as performance, ride, and handling, that a customer is looking for, sales workers invite their customers to test-drive the cars. Most people want to bargain over the price of cars or the allowance they get for their trade-ins, and some dealers expect their sales workers to negotiate, especially if they are overstocked that month. A sales worker generally knows what price the dealer will accept, but no sale is final until the manager approves the terms the sales worker has offered.

The final step of overcoming the customers' hesitancy to buy and getting the order (closing the sale) is difficult in any sales work. Closing is especially difficult in automobile sales because cars are the most expensive purchase many people can make. Since closing the sale frequently is difficult for beginners, experienced sales workers or sales managers often lend assistance.

Once the sale is made, the car must be registered with the State department of motor vehicles and license plates must be obtained. Sales workers fill out the forms necessary for these items, and if customers desire, arrange for financing and insurance as well. Finally, sales workers set up a delivery date for the cars and answer any additional questions the customers may have.

The success of automobile sales workers often depends on their ability to gain the respect and trust of their customers.

Successful sales workers always seek to develop customer loyalty and in this manner build repeat business. Therefore, following delivery, they often contact customers to thank them for their business and to ask if they are satisfied with the car. From time to time, they also may send literature on new models to customers in order to build repeat business.

Successful sales workers cannot simply wait for prospects to walk into the showroom. Instead, they must develop and follow leads on prospective customers. For example, they obtain names of prospects from automobile registration records and from dealer sales, service, and finance records. They also can get leads from gas station operators, parking lot attendants, and others whose work brings them into frequent contact with car owners. After obtaining their leads, sales workers may contact prospects by phone or mail.

Places of Employment

About 130,000 persons worked as automobile sales workers in 1976. New-car dealers employed about four-fifths of the total, and used-car dealers employed the rest. Dealerships vary greatly in size and employment. Many small used-car dealerships employ only one sales worker, while some new car dealerships employ more than 50 sales workers and sell over a thousand cars a year.

Automobile sales workers are employed throughout the country. Most, however, work in heavily populated areas.

Training, Other Qualifications, and Advancement

Most beginners are trained on the job by sales managers and experienced sales workers, with the amount of training depending on the dealer. In large dealerships, beginners may receive several days of classroom training to learn how to obtain leads on prospective customers, to make sales presentations, and to close sales. In addition, automobile manufacturers often furnish training manuals and other educational material for sales workers to study on their own. In almost every dealership, sales workers receive continuing guidance and training from their managers, both on the job and at periodic sales meetings. They also may attend the training programs automobile manufacturers offer when

they develop new sales campaigns that they want their dealers to follow.

A high school diploma usually is the minimum educational requirement for beginners. Courses in English or public speaking, in particular, can help build confidence in one's ability to talk to customers. Also, courses in commerical arithmetic, merchandising, selling, business law, and psychology can provide a good background for this type of work. Previous sales experience or other work requiring contact with the public is not required, but it is helpful. Many persons in automobile sales, for example, previously were in furniture, appliance, or door-to-door sales.

Since automobiles are a major purchase, dealers prefer sales workers who exhibit the maturity which can inspire customer confidence. As a result, many employers prefer applicants who are at least in their mid- or late twenties, with 21 as the minimum age for beginners. But age requirements may be waived for a mature applicant.

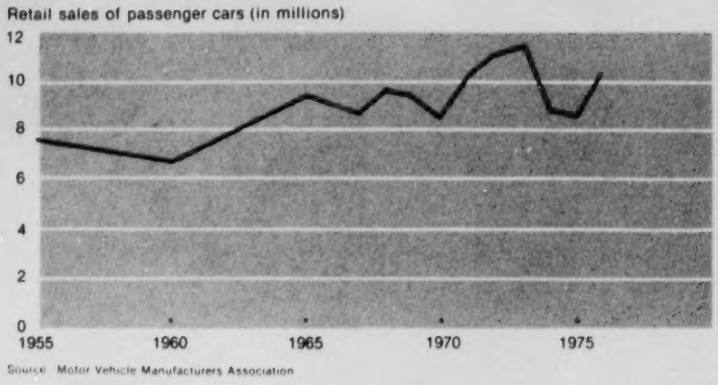
The success of automobile sales workers is often dependent on their ability to gain the respect and trust of their customers. Therefore, they must be tactful, well-groomed, and able to express themselves well. Initiative and aggressiveness also are important since the number of cars sold usually depends on the number of prospective customers contacted. Because automobile sales workers occasionally work for days without making a sale, they need self-confidence and determination to get through these slow periods.

Successful employees who have managerial ability may advance to assistant sales manager, sales manager, or general manager. Many successful employees prefer to remain sales workers however, for they enjoy the freedom of changing dealerships or working in different parts of the country. Some managers and general managers open their own dealership or become partners in dealerships.

Employment Outlook

Employment of automobile sales workers is expected to grow faster than the average for all occupations through the mid-1980's as the demand for automobiles increases. In addition to jobs resulting from employment growth, thousands of openings will occur as sales workers retire, die, or transfer to other occupations.

Auto sales fluctuate from year to year, causing job opportunities for automobile salesworkers to be abundant in some years and scarce in others



Source: Motor Vehicle Manufacturers Association

Over the long run, rising population and personal incomes will lead to increased car sales, and employment of sales workers will grow. But, because sales are affected by changing economic conditions and consumer preferences, employment will fluctuate from year to year. Opportunities for beginners, therefore, will be plentiful in some years and scarce in others.

Earnings and Working Conditions

Most sales workers are paid a commission, that is, a percentage either of the price of every car they sell or the profit the dealer makes on each sale. They may earn another commission when customers finance or insure their cars through the dealer. Because car sales vary from month to month, sales workers' commissions also vary. Many dealers pay their commissioned sales workers a modest weekly or monthly salary so that they will have a steady income. Others give their sales workers advances against future commissions. A few dealers pay a straight salary. Because it takes some time for beginners to learn to sell cars, dealers often guarantee them a modest salary for the first few weeks or months.

Sales workers employed by new-car dealers had estimated average weekly earnings of about $300 in 1976. Earnings varied, depending on individual ability and experience, geographic location, and dealership size. For example, sales workers who worked for dealers that sold between 100 and 149 new vehicles annually averaged about $220 a week, while those employed by dealers that sold 1,000 cars or more averaged about $340.

Many dealerships, especially the larger ones, also provide bonus and other special incentive programs for their sales workers. For example, a sales worker may receive a bonus for selling more cars than expected.

Earnings can change considerably from year to year due to changes in the demand for cars. In lean years, workers with poor sales records may be laid off, or may quit to find better paying jobs in other fields. Many, however, return to selling when the demand for cars improves.

Sales workers receive many fringe benefits. Dealers often furnish their sales staffs with demonstrator cars free of charge, or sell or lease demonstrators at a discount. Sales work-

ers also receive discounts on cars they buy for personal use.

Because most customers find shopping after work convenient, sales workers frequently work evenings. In some areas, they may work Sunday and take a day off during the week. Many dealers assign sales workers "floortime"—hours they spend in the showroom greeting customers. For example, a sales worker may be in the showroom from 9 a.m. to 3 p.m. 1 week, from 3 p.m. to 9 p.m. the next week, and all day on Saturdays. When not assigned to the showroom, they may spend a few hours each day delivering cars to customers and looking for new customers.

Sources of Additional Information

Details on employment opportunities may be obtained from local automobile dealers or the local office of the State employment service. For general information about the work, write to:

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

AUTOMOBILE SERVICE ADVISORS

(D.O.T. 620.281)

Nature of the Work

Service advisors are the link between customers and mechanics in many automobile dealerships and in some large independent garages. When customers bring their cars into the service department, service advisors (sometimes called service salesworkers or service writers) find out what needs to be done and arrange for mechanics to do the work.

For routine maintenance, service advisors merely make out a repair order listing the work that the customer wants done. The order includes the customer's name and address, and make and year of the car. If a factory warranty covers the repairs, the advisor also records the engine and body numbers, mileage, and date of purchase.

There are many times, however, when customers complain of problems that could have a variety of causes. In such cases, service advisors attempt to find out as much as possible about the problem. For example, if a customer says the car is hard to start, the advisor would ask if this happens when the engine is cold or after it warms up. Or, if the complaint is a strange noise, the advisor may look the car over, or test drive the car. The advisor then writes a brief description of the symptoms of the problem, as well as any conclusion about the probable cause, on the repair order to help the mechanic locate the trouble's source.

After writing the repair order, service advisors tell the customer what repairs are needed, their approximate cost, and how long the work will take. Since this cannot always be done until mechanics have inspected the cars, service advisors may phone the customers later to give them this information and to ask permission to do the work. Sometime customers are reluctant to authorize expensive repairs even if they are necessary so service advisors may assure them that the work will improve performance and safety, and prevent more serious trouble.

Service advisors give repair orders to the shop dispatcher who figures the cost of the parts and labor needed for each order and assigns work to mechanics. In some shops however, advisors compute repair costs. Service advisors also are responsible for answering any questions the mechanics may have about a repair order. When the work is finished, service advisors may test drive cars to be sure all problems have been corrected.

When the customer returns for the car, the service advisor answers any questions about the repairs and settles complaints about their cost or quality. If the customers want to return the car to the shop or want the cost of the repairs adjusted, the advisor usually must get permission from the service manager. In some dealerships, the most experienced service advisors substitute for service managers when they are absent.

Service advisor prepares repair order.

In addition to advising customers on their service needs, service advisors occasinally assist customers in selecting accessories for their cars. For example, a customer who wants to add an air-conditioner may check with a service advisor to be sure that the one selected will not cause the car's engine to overheat.

Places of Employment

More than 20,000 persons worked as automobile service advisors in 1976. Most worked for large automobile dealers because dealerships with less than 20 employees usually do not employ service advisors. Some worked for large independent automobile repair shops.

Training, Other Qualifications, and Advancement

Service advisors learn on the job under the guidance of experienced service advisors and the service manager. In many service departments, trainees begin by helping the shop dispatcher. They learn how to route work to the shop mechanics, to compute repair costs, and to estimate the time required for different repairs. Beginners usually can gain enough knowledge and experience in 1 to 2 years to handle almost every type of repair, but learning to estimate the cost of automobile body repairs may take a longer time, as body damage is often very difficult to see and identify. In addition to on-the-job training, some advisors attend formal training programs conducted by automobile manufacturers.

When hiring persons for jobs as service advisor trainees, employers prefer high school graduates who are 21 years of age and who have experience in automobile repair or related activities, such as assignment to the motor pool in the Armed Forces. Often employers fill these jobs by promoting persons who have worked as mechanic trainees or parts counter worker trainees within their own organization. Some firms prefer to hire mechanics who are experienced in all aspects of automobile repair.

Many autombile dealers consider service advisors their most important employees, because they can promote dealership loyalty and thus build repeat business by winning customer confidence.

Therefore, employers look for applicants who are neat, courteous, even-tempered, attentive listeners, and good conversationalists. High school and vocational school courses in automobile mechanics, commercial arithmetic, sales, public speaking, and English are helpful.

Service advisors with supervisory ability may advance to shop supervisors or to service managers. Some open their own automobile repair shops.

Employment Outlook

Employment in this small occupation is expected to increase about as fast as the average for all occupations through the mid-1980's. Not only will there be more automobiles on the road, but also future technology and design will make cars more complex. As a result, more service advisors will be needed. In addition to the job openings resulting from employment growth, hundreds of openings will arise each year due to the need to replace experienced service advisors who retire, die, or leave the occupation for other reasons. The number of openings is expected to be fairly stable from year to year, because the demand for automobile repairs is not very sensitive to changing economic conditions.

Job openings for service advisors will be concentrated in large automobile dealerships, most of which are located in heavily populated areas. In small towns, many dealers do not have enough repair business to hire service advisors so shop supervisors do the work instead.

Earnings and Working Conditions

Service advisors employed by automobile dealers in 36 large cities had estimated average earnings of $6.45 an hour in late 1976, more than one-third higher than the average for all nonsupervisory workers in private industry, except farming.

Many service advisors are paid a salary plus a commission, that is, a percentage of the cost of repairs or accessories that their customers paid for. Others are paid a straight commission.

Most service advisors work 40 to 48 hours a week. They are busiest in the early morning when most customers bring their cars in for repairs, and in late afternoon when they return to pick them up. During these peak hours, advisors may have to rush to wait on customers. In addition, they occasionally have to deal with angry customers who question or are not satisfied with the repairs made on their cars.

Service advisors spend most of their time standing or walking around the lot and garage in all kinds of weather. But the work is not physically strenuous.

Unions that organize service advisors include the International Association of Machinists and Aerospace Workers; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

Details on employment opportunities may be obtained from local automobile dealers or repair shops; locals of the unions previously mentioned; or the local office of the State employment service.

For general information about the work of automobile service advisors, write to:

Automotive Service Industry Association, 230 N. Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils, Inc., 188 Industrial Dr. Suite 112, Elmhurst Ill. 60126

GASOLINE SERVICE STATION ATTENDANTS

(D.O.T. 915.867)

Nature of the Work

At least once a week, most of the 137 million motor vehicles on the road are driven into gasoline service stations for fuel and service. Most need only a few gallons of gas and a clean windshield, but service station attendants check for other things as well to help owners keep their cars in good condition.

Attendant checking the oil level in the crankcase.

Unless a driver is in a hurry, attendants usually check the oil level in the crankcase and the water levels in the battery and radiator. If the customer asks, they also will check the air pressure in the tires and examine fan belts, hoses, and other parts for signs of excessive wear that could cause problems for the driver.

Besides offering these basic services, many stations also do repair work and stock replacement parts for often-needed items such as batteries, headlights, and windshield wiper blades. Attendants sell and install these parts, and in some cases, may do minor repair work, such as changing oil, rotating tires, and fixing flats. Most of these tasks can be done using screwdrivers, pliers, wrenches, and other simple handtools. Some attendants, called mechanic-attendants, perform more difficult repairs and use more complex equipment including motor analyzers and wheel alignment machines.

When customers pay for their purchases or repair work, attendants collect payments and make change or prepare charge slips.

Attendants also may keep the service areas, building, and restrooms clean and neat. In some stations, they help the station manager take inventory of automobile parts in stock, set up displays, and keep business records.

If a service station provides emergency road service, attendants may drive a tow truck to the site of the breakdown to "boost" the battery, change a flat tire, or perform other minor repairs. If they cannot fix the car on the spot, they tow it back to the station.

Places of Employment

About 420,000 people worked as gasoline service station attendants in 1976. About one-third of these were part-time employees. In addition to attendants, more than 200,000 gasoline service station managers and owners did similar work.

Service station attendants work in every section of the country, and in every size community, from rural areas to the largest cities.

Training, Other Qualifications, and Advancement

Applicants for jobs as gasoline service station attendants should have a driver's license, a general understanding of how an automobile works, and some sales ability. They should be friendly, able to speak well, and present a generally neat appearance. They also need self-confidence. Applicants should know simple arithmetic so they can make change quickly and accurately and help keep business records. They also should be familiar with local roads, highways, and points of interest in order to give directions to customers and to locate cars whose owners have called for road service.

Although completion of high school is not generally a requirement for getting an entry job, it is an advantage because it indicates to many employers that the person has at least some of the traits of a good worker, such as the ability to stay with a job until the work is completed. A high school education usually is required for service station management training programs conducted by oil companies.

Service station attendants receive most of their training on the job, although there are some formal training programs. Trainees do relatively simple work at first, such as cleaning the station, pumping gas, and cleaning windshields. Gradually, they progress to more advanced work such as performing preventive maintenance, installing accessories on cars, and helping to keep the station records. It usually takes from several months to a year for a beginner to become familiar with and able to perform all the the jobs around a service station.

Formal training programs for gasoline service station work are offered in many high schools around the country. In this curriculum, students in their last 2 years of high school take business education courses and work part time in gasoline service stations, where they receive instruction in all phases of service station work.

Some attendants are enrolled in formal training programs for service station managers, which are conducted by most major oil companies. These programs usually last from 2 to 8 weeks and emphasize subjects such as simple automobile maintenance, marketing, and business management.

Several avenues of advancement are open to service station attendants. Additional training qualifies attendants to become automobile mechanics; those having business management capabilities may advance to station manager. Many experienced station managers and automobile mechanics go into business for themselves by leasing a station from an oil company or buying their own station. Oil companies hire some service station managers as sales representatives or district managers.

Employment Outlook

Employment of gasoline service station attendants should continue to grow over the next few years. But whether this trend will continue through the mid-1980's is difficult to judge. Increased sales of cars that offer better gas mileage could eventually reduce total gasoline consumption, which might severely limit growth in this occupation over the long run. Self-service gas stations also may limit growth. However, in this relatively large occupation, thousands of job openings are expected each year to replace workers who retire or die. Turnover also is high, so thousands more openings will arise each year as attendants transfer to other occupations.

Earnings and Working Conditions

Earnings of gasoline service station attendants vary considerably. Hourly earnings for many attendants ranged from $2.30 to $4 in 1976, according to the limited information available. In addition, many attendants are paid a commission based on the value of the products they sell. Attendants employed in large metropolitan areas generally had higher earnings than those in small towns.

Full-time attendants work 40 hours a week or more. Because gas stations usually are open at least 12 hours a day, 6 days a week, work schedules may include evenings, weekends, and holidays.

Attendants work outdoors in all kinds of weather. They do considerable lifting and stooping and spend much time on their feet. Possible injuries include cuts from sharp tools and burns from hot engines.

For many attendants, however, the opportunity to deal with people, to work on cars, and possibly to manage their own service stations someday more than offsets these disadvantages. Also, the opportunity to get part-time employment makes the job attractive to many people. Some college students have been able to work their way through school as service station attendants and many who hold other jobs add to their income by working part time as attendants.

Sources of Additional Information

For more details about work opportunities, contact local gasoline service stations or the local office of the State employment service.

INSURANCE AGENTS AND BROKERS

(D.O.T. 250.258)

Nature of the Work

Insurance agents and brokers sell policies that protect individuals and businesses against future losses and financial pressures. They may help plan financial protection to meet the special needs of a customer's family; advise about insurance protection for an automobile, home, business, or other property; or help a policyholder obtain settlement of an insurance claim.

Agents and brokers usually sell one or more of the three basic types of insurance: life, property-liability (casualty), and health. Life insurance agents, sometimes called life underwriters, offer policies that pay survivors when a policyholder dies. Depending on the policyholder's individual circumstances, a life policy can be designed to provide retirement income, funds for the education of children, or other benefits. Casualty insurance agents sell policies that protect individual policyholders from financial losses as a result of automobile accidents, fire or theft, or other losses. They also sell industrial or commercial lines, such as workers' compensation, product liability, or medical malpractice insurance. Health insurance policies offer protection against the costs of hospital and medical care or loss of income due to illness or injury, and many life and casualty agents offer health insurance in addition to other lines. Many agents also offer securities, such as mutual fund shares or variable annuities.

An insurance agent may be either an insurance company employee or an independent business person authorized to represent one insurance company or more. Brokers are not

Insurance agents plan insurance programs that are tailored to prospects' needs.

under exclusive contract with any single company; instead, they place policies directly with the company that best meets a client's needs. Otherwise, agents and brokers do much the same kind of work.

They spend most of their time discussing insurance needs with prospective and existing customers. Some time must be spent in office work to prepare reports, maintain records, plan insurance programs that are tailored to prospects' needs, and draw up lists of prospective customers. Specialists in group policies may help an employer's accountants set up a system of payroll deductions for employees covered by the policy.

Places of Employment

About 465,000 agents and brokers sold insurance full time in 1976. In addition, thousands of others worked part time. About half of the agents and brokers specialized in life insurance; the rest, in some type of property/liability insurance. A growing number of agents (called multi-line agents) offer both life and property-liability policies to their customers.

Agents and brokers are employed in cities and towns throughout the country, but most work near large population centers.

Training, Other Qualifications, and Advancement

Although many employers prefer college graduates for jobs selling insurance, most will hire high school graduates with potential or proven sales ability. College training may help the agent grasp the fundamentals and procedures of insurance selling more quickly. Courses in accounting, economics, finance, business law, and insurance subjects are helpful.

All agents and most brokers must obtain a license in the State where they plan to sell insurance. In most States, licenses are issued only to applicants who pass written examinations covering insurance fundamentals and the State insurance laws. Agents who plan to sell mutual fund shares and other securities also must be licensed by the State. New agents usually receive training at the agencies where they will work and frequently also at the insurance company's home office. Beginners sometimes attend company-sponsored classes to prepare for examinations. Others study on their own and accompany experienced sales workers when they call on prospective clients.

Agents and brokers can broaden their knowledge of the insurance business by taking courses at colleges and universities and attending institutes, conferences, and seminars sponsored by insurance organizations. The Life Underwriter Training Council (LUTC) awards a diploma in life insurance marketing to agents who successfully complete the Council's 2-year life program. There is also a course in health insurance. As agents or brokers gain experience and knowledge, they can qualify for the Chartered Life Underwriter (CLU) designation by passing a series of examinations given by the American College of Bryn Mawr, Pa. In much the same way, a property-liability agent can qualify for the Chartered Property Casualty Underwriter (CPCU) designation by passing a series of examinations given by the American Institute for Property and Liability Underwriters. The CLU and CPCU designations are recognized marks of achievement in their respective fields.

Agents and brokers should be enthusiastic, self-confident, and able to communicate effectively. Because agents usually work without supervision, they need initiative to locate new prospects. For this reason, many employers seek people who have been successful in other jobs.

Insurance agents who show unusual sales ability and leadership may become a sales manager in a local office or assume a managerial job in a home office. A few agents may advance to top positions as agency superintendents or company vice-presidents. Many who have built up a good clientele prefer to remain in saleswork. Some, particularly in the property-liability field, eventually establish their own independent agencies or brokerage firms.

Employment Outlook

Employment of insurance agents and brokers is expected to grow about as fast as the average for all occupations through the mid-1980's as the volume of insurance sales continues to expand. Many additional jobs will open as agents and brokers die, retire, or leave their jobs to seek other work. Due to the highly competitive nature of insurance selling, many beginners leave the field because they are unable to establish a sufficiently large clientele. Therefore, opportunities should be quite favorable for ambitious people who enjoy saleswork.

Future demand for agents and brokers depends on the volume of insurance sales. Volume should increase rapidly over the next decade as a larger proportion of the population enters the period of peak earnings and family responsibilities. Life insurance sales should grow as more families select policies designed to provide educational funds for their children and retirement income. Rising incomes also may stimulate the sales of equity products such as mutual funds, variable annuities, and other investments. Sales of property-liability insurance should rise as more consumer purchases are insured and as complex types of commercial coverage, such as product liability and workers'compensation, are expanded.

However, employment of agents and brokers will not keep pace with the rising level of insurance sales because more policies will be sold to groups and by mail. In addition, each agent should be able to handle more business as computers take over some of the time-consuming clerical tasks. The trend toward multi-line agents also will cause employment to rise more slowly than the volume of insurance sales.

Earnings and Working Conditions

Beginners in this occupation often are guaranteed a moderate salary while they are learning the business and building a clientele. In many large companies, new agents receive about $800 a month during this training period, which can last up to 6 months or longer. Thereafter, most agents are paid on a commission basis. The size of the commission depends on the type and amount of in-

surance sold, and whether the transaction is a new policy or a renewal. After a few years, an agent's commissions on new policies and renewals may range from $12,000 to $20,000 annually. There is virtually no limit on what an agent can earn, however. Thousands of established agents and brokers earn more than $30,000 a year, and many highly successful ones earn more than $100,000 a year.

Agents and brokers generally pay their own automobile and traveling expenses. In addition, those who own and operate independent businesses must pay office rent, clerical salaries, and other operating expenses out of their earnings.

Although insurance agents usually are free to arrange their own hours of work, they often schedule appointments during evenings and weekends for the convenience of clients. Some agents work more than the customary 40 hours a week. (See the statement on the Insurance Industry for more information about work in life and property-liability companies.)

Sources of Additional Information

General occupational information about insurance agents and brokers is available from the home office of many life and property-liability insurance companies. Information on State licensing requirements may be obtained from the department of insurance at any State capital.

Information about a career as a life insurance agent also is available from:

American Council of Life Insurance, 1850 K St., NW., Washington, DC, 20006.

The National Association of Life Underwriters, 1922 F St., NW., Washington, D.C. 20006.

For career information on property/liability agents, contact:

Insurance Information Institute, 110 William St., New York, N.Y. 10038.

National Association of Insurance Agents, Inc., 85 John St., New York, N.Y. 10038.

American Mutual Insurance Alliance, 20 N. Wacker Dr., Chicago, Ill. 60606.

The National Association of Independent Insurers, Public Relations Department, 2600 River Rd., Des Plaines, Ill. 60018.

MANUFACTURERS' SALES WORKERS

(D.O.T. 260. through 298.458)

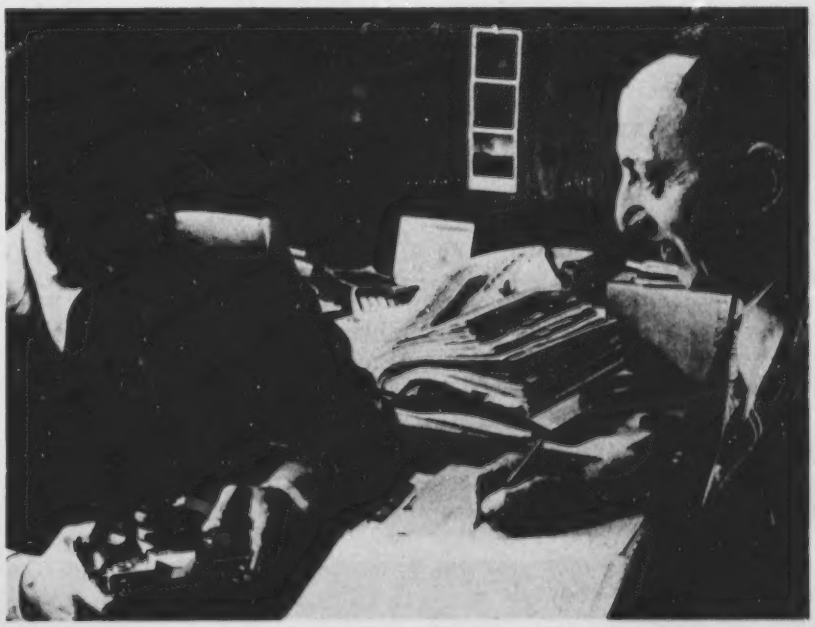
Nature of the Work

Practically all manufacturers—whether they make computers or can openers—employ sales workers. Manufacturers' sales workers sell mainly to other businesses—factories, railroads, banks, wholesalers, and retailers. They also sell to hospitals, schools, libraries, and other institutions.

Most manufacturers' sales workers sell nontechnical products. They must be well informed about their firms' products and also about the special requirements of their customers. When sales workers visit firms in their territory, they use an approach adapted to the particular line of merchandise. A sales worker who handles crackers or cookies, for example, emphasizes the wholesomeness, attractive packaging, and variety of these products. Sometimes sales workers promote their products by displays in hotels and conferences with wholesalers and other customers.

Sales workers who deal in highly technical products, such as electronic equipment, often are called sales engineers or industrial sales workers. In addition to having a thorough knowledge of their firms' products, they must be able to help prospective buyers with technical problems. For example, they may try to determine the proper materials and equipment for a firm's manufacturing process. They then present this information to company officials and try to negotiate a sale, which may take many months. Often, sales engineers work with the research-and-development departments of their own companies to devise ways to adapt products to a customer's specialized needs. Sales workers who handle technical products sometimes train their customers' employees in the operation and maintenance of new equipment, and make frequent return visits to be certain that it is giving the desired service.

Although manufacturers' sales workers spend most of their time visiting prospective customers, they also do paperwork, including reports on sales prospects or customers' credit ratings. In addition, they must plan their work schedules, draw up



Manufacturer's sales worker takes order for camera equipment from department store photo supplies buyer.

lists of prospects, make appointments, handle some correspondence, and study literature relating to their products.

Places of Employment

Over 360,000 people were manufacturers' sales workers in 1976. About 15,000 were sales engineers. Some work out of their company's home office, often located at a manufacturing plant. The majority, however, work out of branch offices, usually in big cities near prospective customers.

More sales workers are employed by companies that produce food products than by any other industry. Large numbers also work in the printing and publishing, chemical, fabricated metal products, and electrical and other machinery industries. Most sales engineers work for companies that produce heavy machinery, transportation equipment, fabricated metal products, and professional and scientific instruments.

Training, Other Qualifications, and Advancement

Although a college degree is increasingly desirable, the type and level of education a sales worker needs depend largely on the product and its market.

Manufacturers of nontechnical products often hire college graduates who have a degree in liberal arts or business administration. Some positions, however, require specialized training. Drug sales workers, also known as pharmaceutical detailers, usually need training at a college of pharmacy. Manufacturers of electrical equipment, heavy machinery, and some types of chemicals prefer to hire people who have studied engineering or chemistry. (Information on chemists, engineers, and others with the technical training suitable for work as manufacturers' sales workers is given elsewhere in the *Handbook*.)

Beginning sales workers may take specialized training before they start on the job. Some companies, especially those that manufacture complex technical products, have formal training programs that last 2 years or longer. In some of these programs, trainees rotate among jobs in several departments of the plant and office to learn all phases of production, installation, and distribution of the product. Other trainees take formal class instruction at the plant, followed by on-the-job training in a branch office under the supervision a field sales manager.

A pleasant personality and appearance, and the ability to meet and get along well with many types of people are important. Because sales workers may have to walk or stand for long periods or carry product samples, some physical stamina is necessary. As in most selling jobs, arithmetic skills are an asset.

Sales representatives who have good sales records and leadership ability may advance to sales supervisors, branch managers, or district managers. Those with managerial ability eventually may advance to sales manager or other executive positions; many top executive jobs in industry are filled by people who started as sales workers.

Because of frequent contact with business people in other firms, sales workers often are able to transfer to other jobs. Some go into business for themselves as independent representatives. Other experienced sales workers find opportunities in advertising and marketing research.

Employment Outlook

Employment in this field is expected to grow about as fast as the average for all occupations. Growth will occur because of the rising demand for technical products and the resulting need for trained sales workers. In addition, industrial firms, chain stores, and institutions that purchase large quantities of goods at one time frequently buy directly from the manufacturer. The need for sales workers will increase as manufacturers emphasize sales activities to compete for the growing number of these valuable accounts.

Earnings and Working Conditions

According to the limited information available, salaries for inexperienced sales workers ranged from $6,000 to over $24,000 a year in 1976, exclusive of commissions and bonuses. The highest starting salaries generally were paid by manufacturers of electrical equipment, food products, and rubber goods. The average experienced sales worker earned between $17,000 and $30,000 in 1976, depending upon the firm and its product. The highest paid sales workers sometimes earned upwards of $40,000 and $50,000.

Some manufacturing concerns pay experienced sales workers a straight commission, based on their dollar amount of sales (as in the case of independent representatives); others pay a fixed salary. The majority, however, use a combination of salary and commission, salary and bonus, or salary, commission, and bonus. Commissions vary according to the sales workers' efforts and ability, the commission rate, the location of their sales territory, and the type of product sold. Bonus payments may depend on individual performance, on performance of all sales workers in the group or district, or on the company's sales. Some firms pay annual bonuses; others offer bonuses as incentive payments on a quarterly or monthly basis.

Some manufacturers' sales workers have large territories and do considerable traveling. Others usually work in the neighborhood of their "home base." When on business trips, sales workers are reimbursed for expenses such as transportation and hotels. Some companies provide a car or pay a mileage allowance to sales workers who use their own cars.

Manufacturers' sales workers call at the time most convenient to customers and may have to travel at night or on weekends. Frequently, they spend evenings writing reports. However, some plan their schedules for time off when they want it. Most sales workers who are not paid a straight commission receive 2 to 4 weeks' paid vacation, depending on their length of service. They usually share in company benefits, including life insurance, pensions, and hospital, surgical, and medical benefits.

Sources of Additional Information

For more information on the occupation of manufacturers' sales worker, write:

Sales and Marketing Executives International, Career Education Division, 380 Lexington Ave., New York, N.Y. 10017.

Manufacturer's Agents National Association, P.O. Box 16878, Irvine, Cal. 92713.

MODELS

(D.O.T. 297.868 and 961.868)

Nature of the Work

Selling a product always is easier if an attractive man or woman is shown using it. In magazine advertisements and television commercials, models can be seen posing with a wide variety of products, including cars, soft drinks, and perfume. Most models, however, are used to show the latest in fashion designs and cosmetics.

Models usually specialize in either live or photographic work. *Fashion models* generally work before an audience, modeling the creations of well-known designers at fashion shows. While the announcer describes what they are wearing, they walk past customers and photographers and point out special features of the design. On some jobs, they may stop to tell individual customers a garment's price and style number.

Fashion models who work for clothing designers, manufacturers, and distributors are called *showroom* or *fitting models*. When new spring or fall designs are being shown to prospective buyers, these models are extremely busy. During slack times, however, they may have some general office duties, such as typing or filing.

Some *informal models* work in department stores and custom salons where the pace is more leisurely than in showrooms. Others demonstrate new products and services at manufacturers' exhibits and trade shows.

Photographic models usually are hired to pose for a particular assignment. Although most model clothes and cosmetics, they often pose with other merchandise as well. In addition to fashion and photographic work, some models pose for artists or sculptors, or work in films or television.

Places of Employment

About 8,300 models were employed in 1976. Clothing manufacturers, designers, and wholesalers employ the largest number of models. In New York City's garment district, hundreds of firms each employ one or two permanent models to show their latest fashion designs to prospective retail buyers. Many models work for agencies, however. Advertising agencies, retail stores, magazines, and photographers almost always employ agency models for their fashion articles or advertisements.

Modeling jobs are available in nearly all urban areas, but most jobs

Fashion models generally work before an audience.

are in New York City because it is the center of the fashion industry. Chicago, Detroit, and Los Angeles are the other cities with many jobs for models.

Training, Other Qualifications, and Advancement

The most important asset for a model is a distinctive and attractive physical appearance. Advertisers and clothing designers hire models who have the right "look" for their product and a face or style that will be remembered. To develop an individual style, some models attend a modeling school where they learn to style their hair, walk and stand gracefully, pose in front of a camera, and apply makeup. Those interested in a modeling career should understand the distinction between these schools and modeling agencies. The main business of schools is teaching classes; they usually do not help the graduate find work. Agencies, on the other hand, find and schedule assignments for their models on a commission basis, ranging from 10 to 20 percent. Some modeling agencies also provide training, but normally accept only the most promising beginners.

Female models must be between 5 feet 7 inches and 5 feet 9 1/2 inches tall and weigh 110 to 122 pounds. Male models must be 6 feet tall and wear a size 40 suit. Size requirements are quite rigid because manufacturers' and designers' samples are standard and models must fit the clothes without alteration.

Photographic models usually are thinner than fashion models because the camera adds at least 10 pounds to a person's appearance. In addition, they must have fine, regular features and good teeth, hands, and legs. Wide set eyes and a long neck are also essential.

There are no educational requirements for models; some have completed high school and others have had college training. Courses in drama, dancing, art, and fashion design are useful because they can develop poise and a sense of style.

Models should enjoy working with people and must be able to withstand the pressures of competition, tight schedules, and quick changes. Physical stamina is important because models are on their feet most of the time and must sometimes assume rather awkward positions when posing for photographers. To look their best under such pressure, models must maintain excellent health.

Modeling agencies find jobs for their models on a continuous basis. Usually, they help their models obtain, often without charge, a portfolio of photographs of themselves in various styles and poses which the agency can show to prospective clients. Some department stores hold auditions that give inexperienced models a chance to model at a fashion show and perhaps obtain other jobs if they do well.

In addition, many sales jobs in department stores provide useful experience in selecting and coordinating fashions, experimenting with makeup, and, occasionally, modeling. Sometimes a model can gain experience by working in fashion shows given by local community organizations.

Modeling can be a stepping stone to other jobs in the fashion field, such as staff editor of a fashion magazine, consultant for a cosmetic firm, or fashion coordinator for a department store. Some models take courses in art and design and may become fashion illustrators or designers. A few models who work in television commercials become actors or actresses.

Employment Outlook

Although employment of models is expected to increase faster than the average for all occupations through the mid-1980's, competition for the available jobs will be keen. The glamour of modeling attracts many more persons than are needed in the occupation. Even though many interested persons do not meet the size requirements, those who do still outnumber available jobs. Experienced models will continue to receive most of the assignments.

Rising advertising expenditures and sales of clothing and accessories will cause the demand for both photographic and fashion models to increase. Most job openings, however, will result from the need to replace models who have left the occupation. Many models have to retire when they lose their youthful appearance because most employers prefer younger models. Others leave the occupation because their particular "look" goes out of style or becomes associated with an outdated product.

Earnings and Working Conditions

A model's earnings depend on the number and length of assignments he or she receives. Although a few top models earn as much as business executives, most earn far less. According to the limited information available, fashion models working full time for manufacturers or wholesalers earned up to $35,000 in 1976, though only the very best earned the highest income. Models working retail shows on a steady basis earned $10,000 to $12,000 outside New York City; those in New York earned more.

Models who work for more than one employer receive a fee for their work. If they are registered with an agency, they pay a commission for the services it provides. In 1976, female models working for major agencies in New York earned $75 to $100 an hour; male models, up to $75 an hour. Models in other major cities earned slightly lower rates. These rates are misleading, however, because many models, especially beginners, work only a few hours each week and spend a great deal of their time auditioning for prospective clients. Models' income also depends on the type of work they do, whether runway or photographic work. The more versatile the model, the greater the number of assignments and the greater the income he or she may receive. Although photographic modeling often pays well, models usually must provide their own accessories, such as wigs and hairpieces, and pay for their transportation. Occasionally, a model must buy a complete outfit in order to get a particular job.

Models appearing in television commercials earn at least $145 for a job as an extra, and about $200 per job as a principal character; they may also receive additional income if the commercial is rerun. Television models must be members of the Ameri-

can Federation of Television and Radio Artists or the Screen Actors Guild, Inc.

Models sometimes must work under uncomfortable conditions, posing in a swimsuit in the middle of winter, for example. The work can also affect their personal lives because models must always look fresh and well-rested for the camera and may have to limit evenings out with friends. In addition, a female model must spend part of each night on beauty care, and sometimes has to prepare her clothing and accessories, polish her nails, and set her hair for the next day's assignments.

Sources of Additional Information

Employers of models such as magazines and newspapers may be able to recommend reputable modeling agencies. More comprehensive information on training programs for models is available on request from:

United States Office of Education, Division of Vocational/Technical Education, Washington, D.C. 20202.

REAL ESTATE AGENTS AND BROKERS

(D.O.T. 250.358)

Nature of the Work

Real estate agents and brokers represent property owners in selling or renting their properties. Brokers who belong to the National Association of Realtors receive the title, "Realtor;" agents who are members may use the title, "Realtor-Associate."

Brokers are independent business people who not only sell real estate, but also rent and manage properties, make appraisals, and develop new building projects. In closing sales, brokers usually arrange for loans to finance the purchases, for title searches, and for meetings between buyers and sellers when details of the transaction are agreed upon and the new owners take possession. Brokers also manage their own offices, advertise properties, and handle other business matters. Some combine other types of work, such as selling insurance or practicing law, with their real estate business.

Real estate agents generally are independent sales workers who contract their services with a licensed broker. Ways of doing business have changed in the last 10 years or so, and today, relatively few agents work as employees of a broker or realty firm.

Agents show and sell real estate, handle rental properties, and obtain "listings" (owner agreements to place properties for sale with the firm). Because obtaining listings is such an important job duty, agents may spend much time on the telephone exploring leads gathered from advertisements and personal contacts. When listing property for sale, agents make comparisons with similar property being sold to determine its fair market value. They also answer inquiries about properties over the telephone and interview potential buyers about their needs.

A worker who sells real estate or handles rental properties often must leave the office to call on prospects and drive them to inspect available properties. When a number of houses are for sale or rent in a new development, the agent may operate from a model unit.

Most real estate agents and brokers sell residential property. A few, usually in large firms, specialize in commercial, industrial, or other types of real estate. Each specialty requires knowledge of that particular type of property and clientele. Selling or leasing business property, for example, requires an understanding of leasing practices, business trends, and location needs. Agents who sell or lease industrial properties must know about transportation, utilities, and labor supply. To sell residential properties, the agent must know the location of schools, churches, shopping facilities, and public transportation. Familiarity with tax rates and insurance coverages also is important.

Places of Employment

About 450,000 persons sold real estate full time in 1976; many others sold on a part-time basis. The number of people licensed to sell totaled about 1.5 million in 1976, according to the National Association of Real Estate License Law Officials.

Most real estate firms are relatively small; indeed, some brokers operate a one-person business. Some large firms have several hundred real estate agents operating out of many branch offices. Most sales workers, however, work in firms with no more than 5 to 10 other agents. A growing number of brokers, currently about 1 in 5, have entered into franchise agreements with national or regional real estate organizations. Under this type of arrangement, similar to many fast-food restaurant operations, the broker pays a fee in exchange for the privilege of using the more widely known name of the parent organization. Although franchised brokers often receive help in training salespeople and in running their offices, they bear the ultimate responsibility for the success or failure of the firm.

Real estate is sold in all areas, but employment is concentrated in large urban areas and in smaller but rapidly growing communities.

Training, Other Qualifications, and Advancement

Real estate agents and brokers must be licensed in every State and in the District of Columbia. All States require prospective agents to be a high school graduate, be at least 18 years old, and pass a written test. The examination—more comprehensive for brokers than for agents—includes questions on basic real estate transactions and on laws affecting the sale of property. Most States require candidates for the general sales license to complete 30 hours of classroom instruction and those seeking the broker's license to complete 90 hours of formal training in addition to a specified amount of experience in selling real estate (generally 1 to 3 years). Some States waive the experience requirements for the broker's license for applicants who have a bachelor's degree in real estate. State licenses usually can be renewed annually without reexamination.

As real estate transactions have become more complex, many of the

Most real estate sales workers work for small establishments.

large firms have turned to college graduates to fill sales positions. A large number of agents have some college training and the number of college graduates selling real estate has risen substantially in recent years. However, personality traits are fully as important as academic background. Brokers look for applicants who possess such characteristics as a pleasant personality, honesty, and a neat appearance. Maturity, tact, and enthusiasm for the job are required in order to motivate prospective customers in this keenly competitive field. Agents also should have a good memory for names and faces and business details such as taxes, zoning regulations, and local land-use laws.

Young men and women interested in beginning jobs as real estate agents often apply in their own communities, where their knowledge of local neighborhoods is an advantage. The beginner usually learns the practical aspects of the job under the direction of an experienced agent.

Many firms offer formal training programs for both beginners and experienced agents. About 360 universities, colleges, and junior colleges offer courses in real estate. At some, a student can earn an associate's or bachelor's degree with a major in real estate; several offer advanced degrees. Many local real estate boards that are members of the National Association of Realtors sponsor courses covering the fundamentals and legal aspects of the field. Advanced courses in appraisal, mortgage financing, and property development and management also are available through various National Association affiliates.

Trained and experienced agents can advance in many large firms to sales or general manager. Persons who have received their broker's license may open their own offices. Training and experience in estimating property value can lead to work as a real estate appraiser, and people familiar with operating and maintaining rental properties may specialize in property management. Those who gain general experience in real estate, and a thorough knowledge of business conditions and property values in their localities, may enter mortgage financing or real estate counseling.

Employment Outlook

Employment of real estate agents and brokers is expected to rise faster than the average for all occupations in order to satisfy a growing demand for housing and other properties. In addition to opportunities that result from this growth, many openings will occur each year as workers die, retire, or leave for other reasons. Replacement needs are high because a relatively large number of people transfer to other work after a short time selling real estate.

The favorable outlook for employment in this field will stem primarily from increased demand for home purchases and rental units. Shifts in the age distribution of the population over the next decade will result in a larger number of young adults with careers and family responsibilities. This is the most geographically mobile group in our society and the one that traditionally makes the bulk of home purchases. As their incomes rise, these families also can be expected to purchase larger homes and vacation properties. During periods of declining economic activity and tight credit, the volume of sales and the resulting demand for salesworkers may decline. During these periods, the number of persons seeking sales positions may outnumber openings. Over the long run, however, the outlook for salespeople is excellent.

Many job opportunities should occur for both college graduates and mature workers transferring from other kinds of saleswork. This field will remain highly competitive and prospects will be best for well-trained, ambitious people who enjoy selling. The proportion of part-time real estate agents has declined in recent years as brokers have demanded greater skill and professionalism from those selling real estate. This decline is expected to continue as agents need more specialized knowledge to handle real estate transactions.

Earnings and Working Conditions

Commissions on sales are the main source of earnings—very few real estate agents work for a salary. The rate of commission varies according to the type of property and its value; the percentage paid on the sale of farm and commercial properties or unimproved land usually is higher than that paid for selling a home.

Commissions may be divided among several agents in a real estate firm. The person who obtains the listing often receives a part when the property is sold; the broker who makes the sale either gets the rest of the commission or shares it with the agent who handles the transaction. Although an agent's share varies greatly from one firm to another, often it is about half of the total amount received by the firm.

Earnings of full-time real estate agents averaged about $13,700 a year in 1976, according to estimates based on a survey conduct by the National Association of Realtors; agents working fewer than 30 hours a week averaged $3,400. Many experienced real estate agents earn $40,000 a year or more. According to the same survey estimates, real estate brokers earned about $27,000 a year in 1976. Full-time agents earn one and one-half times as much and brokers earn nearly three times as much as average earnings for all nonsupervisory workers in private industry, except farming.

Income usually increases as an agent gains experience, but individual ability, economic conditions, and the type and location of the property also affect earnings. Sales workers who are active in community organizations and local real estate boards can broaden their contacts and increase their earnings. A beginner's earnings often are irregular because a few weeks or even months may go by without a sale. Although some brokers allow an agent a drawing account against future earnings, this practice is not usual with new employees. The beginner, therefore, should have enough money to live on until commissions increase.

Brokers provide office space, but agents generally furnish their own automobiles. Agents and brokers often work in the evenings and during weekends to suit the convenience of customers. Some firms, especially the large ones, furnish group life, health, and accident insurance.

Sources of Additional Information

Details on licensing requirements for real estate agents and brokers are available from most local real estate organizations or from the real estate commission or board located in each State capital. Many States can furnish manuals helpful to applicants who are preparing for the required written examinations.

For more information about opportunities in real estate work, as well as a list of colleges and universities offering courses in this field, contact:

National Association of Realtors, 430 N. Michigan Ave., Chicago, Illinois 60611.

RETAIL TRADE SALES WORKERS

(D.O.T. 260. through 290.877)

Nature of the Work

The success of any retail business depends largely on its sales workers. Courteous and efficient service from behind the counter or on the sales floor does much to satisfy customers and build a store's reputation. Even though contact with customers is a part of all sales jobs, the duties, skills, and responsibilities of sales workers are as different as the kinds of merchandise they sell.

In selling items such as furniture, electrical appliances, or clothing, the sales worker's primary job is to create an interest in the merchandise. The sales worker may answer questions about the construction of an article, demonstrate its use, and show various models and colors. In some stores, special knowledge or skills may be needed to sell the merchandise. In a pet shop, for example, the sales worker should know about the care and feeding of animals. People who sell standardized articles, such as many items in hardware and drugstores, often do little more than take payments and wrap customers' purchases. (In supermarkets and some drugstores, cashiers wrap or bag purchases, receive payments, and make change. See statement elsewhere in the *Handbook* on cashiers.)

In addition to selling, most retail sales workers make out sales or charge slips, receive cash payments, and give change and receipts. They also handle returns and exchanges of merchandise and keep their work areas neat. In small stores, they may help order merchandise, stock shelves or racks, mark price tags, take inventory, and prepare displays. (Route drivers, who sell bread, milk, and other products directly to cus-

The success of any retail business depends largely on its sales workers.

tomers on a regular route, are discussed elsewhere in the *Handbook*.)

Places of Employment

In 1976, more than 2.7 million sales workers were employed in retail businesses. They worked in stores ranging from the small drug or grocery store employing one part-time sales clerk to the giant department store that has hundreds of sales workers. They also worked for door-to-door sales companies and mail-order houses. The largest employers of retail trade sales workers are department stores and those selling general merchandise, apparel and accessories, and food.

Although sales jobs are found in almost every community, most sales workers are employed in large cities and nearby suburban areas.

Training, Other Qualifications, and Advancement

Employers generally prefer high school graduates for sales jobs. Those without a high school diploma can also find jobs, although the work permit requirement complicates the process for those under 18 years of age.

Thousands of high schools across the country have distributive education programs. Generally consisting of a cooperative arrangement between school and business community, these programs allow students to work part time at local stores while taking courses in merchandising, accounting, and other aspects of retailing. The experience and education gained can improve one's prospects for permanent employment.

Many distributive education programs cater to adult and continuing education. In addition, one federally funded project called "70,001" focuses on the needs of disadvantaged youth and high school dropouts. Operating out of school districts and colleges across the Nation, "70,001" combines full-time employment with part-time instruction after hours.

Many high school and colleges have a chapter of Distributive Education Clubs of America (DECA), a service organization dedicated to the goals of distributive education and good citizenship. DECA members—students and faculty—run their local chapter, elect officers, and plan and participate in activities on the local, State, and national levels.

Persons interested in sales jobs should apply to the personnel offices of large retail stores, where they are likely to be interviewed and, in some cases, given an aptitude test. Employers prefer those who enjoy working with people and have the tact to deal with different personalities. Among other desirable characteristics are an interest in sales work, a pleasant personality, a neat appearance, and the ability to communicate clearly. Prospective sales workers should also be willing to stand for long periods.

In many small stores, an experienced employee or the proprietor instructs newly hired sales personnel in making out sales slips and operating the cash register. In larger stores, training programs are likely to be more formal and to include specialized training in selling certain products.

Inexperienced sales workers in department stores typically begin in housewares, notions, and other departments where a customer needs little assistance. As they gain experience and seniority, they move to positions of greater responsibility. Selling "big ticket" items—large appliances, furniture, rugs, and the like—usually requires the most knowledge of the product and the greatest talent for persuasion. In these departments one finds the most experienced—and the highest paid—sales workers.

Retail selling remains one of the few fields in which able employees may advance to executive jobs regardless of educational background. Although large retail businesses generally hire college graduates as management trainees, this is not the only way to move into jobs at the management level. Some sales workers are promoted to jobs as buyers, department managers, or store managers. Others, particularly in large stores, may advance to administrative work in areas such as personnel or advertising. Opportunities for advancement are limited in small stores where one person, often the owner, does most managerial work. Retail selling experience may be an asset in qualifying for sales work with wholesalers or manufacturers.

Employment Outlook

Retail trade selling will continue to be an excellent source of job opportunities for high school graduates even though employment is expected

to increase more slowly than the average for all occupations through the mid-1980's. In addition to full-time jobs, there will be many opportunities for part-time workers, as well as for temporary workers during peak selling periods such as the Christmas season. Prospects are expected to be good because retail selling is a large occupation and turnover is high. Most openings will occur as experienced full- and part-time sales workers leave their jobs.

Rising sales volume and longer store hours will increase the need for sales workers. Sales employment will increase more slowly than the volume of sales, however, as self-service—already the rule in most foodstores—is extended to drug, variety, and other kinds of stores. At the same time, rising income levels may increase the demand for "big ticket" items, such as television sets, that require the sales worker to spend a good deal of time with each customer.

Earnings and Working Conditions

In 1977, the starting wage for most retail sales positions not covered by union contracts was the Federal minimum wage, $2.30 an hour. Exempted were employees of chain firms or independent stores doing less than $250,000 worth of business per year. In stores where it applies, the minimum wage covers part-time and temporary as well as full-time employees.

Stores in major cities usually are covered by union contracts. Most agreements provide for a progressive pay scale based upon experience and length of employment. Straight hourly wages ranged from $2.30 for a beginning full-time clerk to $4.37 for an experienced full-time clerk in 1977.

In addition to their salary, some sales workers receive commissions—that is, a percentage of the sales they make. Still others are paid a straight commission alone. Those paid only by commission may find their earnings greatly affected by ups and downs in the economy. Earnings are likely to be highest in jobs that require special skill in dealing with customers or technical knowledge of the merchandise sold. Among the highest paid are people who sell automobiles, major appliances, and furniture. On the average, retail trade sales workers earn about as much as nonsupervisory workers in private industry, except farming.

Sales workers in many retail stores may buy merchandise at a discount, often from 10 to 25 percent below regular prices. This privilege sometimes is extended to the employee's family. Some stores, especially the large ones, pay all or part of the cost of such employee benefits as life insurance, health insurance, and a pension.

Many full-time sales workers have a 5-day, 40-hour week, although in some stores the standard workweek is longer. Because Saturday is a busy day in retailing, employees usually work that day and have a weekday off. Longer than normal hours may be scheduled before Christmas and during other peak periods, and employees who work overtime receive additional pay or an equal amount of time off during slack periods. Some, especially those employed by stores in suburban shopping centers, regularly work one evening or more a week.

Part-time sales workers generally work during the store's peak hours of business—daytime rush hours, evenings, and weekends.

Sales workers in retail trade usually work in clean, well-lighted places, and many stores are air-conditioned. Some jobs, however, require work outside the store. A kitchen equipment sales worker may visit prospective customers at their homes, for example, to help them plan renovations, and a used-car sales worker may spend much time at an outdoor lot.

Sources of Additional Information

Information about careers in retail sales is available from:

The National Retail Merchants Association, 100 W. 31st St., New York, N.Y. 10001.

Additional information on careers in retailing may be obtained from the personnel offices of local stores; from State merchants' associations; or from local unions of the Retail Clerks International Association.

Information on distributive education programs may be obtained from your State employment service or by writing to:

United States Office of Education, Division of Vocational/Technical Education, Washington, D.C. 20202.

For information about a "70,001" program in your area, write:

"70,001" Limited, Robscott Building, 151 Chestnut Hill Rd., Newark, Del. 19711.

ROUTE DRIVERS

(D.O.T. 292.358)

Nature of the Work

Many industries sell their goods and services through the route drivers who deliver their products. In fact, these workers sometimes are known as driver-sales workers or route-sales workers. Through their selling ability, route drivers increase sales to existing customers and gain additional business by finding new customers within their territories. Also, because route drivers are the customer's contact with the company, their reaction to complaints and requests for special service can make the difference between getting a larger order or losing a customer.

Route drivers' duties vary according to the industry in which they are employed, whether they have a retail or wholesale route, and the policies of their particular company. But, the following specific examples provide a general picture of the job.

On a typical day, drycleaning route drivers begin by picking up cleaned garments at the processing plant. Usually they load their own trucks, carefully arranging the racks of clothes, draperies, and other items in the order in which they will be delivered. As they make their deliveries, they also pick up items customers want cleaned. Drivers tag these items so that they can be returned to the right owner. Sometimes, they note the type of stains to be removed or special processes, such as waterproofing, that customers may request. After delivering the clean gar-

ments, drivers give each customer an itemized bill and collect the money due. Periodically, they stop at homes along their routes to try to sell their company's services.

Many laundries rent linens, towels, work clothes, and other items to businesses. Laundry route drivers service these establishments on a regular basis, replacing soiled items with freshly laundered ones. These route drivers keep a record of what they provide and must make certain that stock rented out is eventually returned. Although they sometimes solicit new business from the smaller establishments in their territory, the larger ones are contacted by other sales workers in their company.

Wholesale bakery route drivers deliver bread, cakes, rolls, and other baked goods to grocery stores. Before starting on their routes, they check to see whether the proper variety and quantity of products have been loaded. Depending on how many items each store stocks, a driver may visit from 10 to 50 grocery stores each day. At each stop along the route, drivers carry the orders of bread and other baked goods into the store and arrange them on the display racks. Together with the store owner or manager, bakery route drivers check the merchandise delivered and prepare a bill. They also credit the store for the value of the stale items left over from the previous delivery.

Bakery route drivers pay close attention to the items that are selling well or sitting on the shelves so that they can estimate the amount and variety of baked goods that will be sold by the grocery stores. This helps the bakery plan its nightly production. From time to time, the drivers visit grocers along the route who are not customers and try to get orders from them.

Vending machine route drivers make certain that the machines in factories, schools, and other buildings on their routes are stocked with merchandise and are in good working order. At each location, they check the items remaining in the machines and remove the money that has been deposited in the cash boxes. Drivers also check each vending machine to see that merchandise and change are dispensed properly, and make minor adjustments to machines that are broken. In addition, they clean machines and replace stock. Route drivers keep records of the merchandise they place in each machine and the money they remove. They may try to find new locations for vending machines by visiting stores, factories, and other businesses along their routes.

Places of Employment

About 200,000 route drivers worked for a wide variety of businesses in 1976. Most were employed in laundries, dairies, bakeries, and firms that distribute food and beverages. Because these are located in small towns as well as in large cities, route driver jobs exist in all parts of the country.

Training, Other Qualifications, and Advancement

Route drivers must be good drivers, and they also must be able to sell. To get people to buy, they must know their product or service thoroughly and be able to convince others to give them a try. Other important sales qualifications are a pleasant voice, an ability to speak well, and a neat appearance. They also need self-confidence, initiative, and tact.

Route drivers must be able to work without direct supervision, do simple arithmetic, and write legibly. In most States, a route driver is required to have a chauffeur's license, which is a commercial driving permit. Information on this license can be obtained from State motor vehicle departments. Route drivers who handle a great deal of money may have to be bonded.

Most employers prefer their route drivers to be high school graduates. A good driving record is important.

Most companies give their new employees on-the-job training which varies in length and thoroughness. Many large companies also have classes in sales techniques.

School-and-work programs in retail and wholesale merchandising are helpful to a person interested in entering this occupation. High school courses in sales techniques, public speaking, driver training, bookkeeping, and business arithmetic also are helpful. Valuable experience can be gained by working as a sales clerk in a store or by taking some other type of selling job.

Some people enter this occupation as *route driver helpers* (D.O.T. 292.887). Helpers assist drivers with loading and unloading the truck and may relieve them of some of the driving. When openings occur, helpers may be promoted to drivers. The dairy and vending machine industries, however, generally do not employ helpers.

Route drivers may be promoted to route or sales supervisor, but these jobs are relatively scarce. Advancement usually is limited to moving from a retail to a wholesale route, where earnings generally are higher. However, some drivers obtain better paying sales jobs as a result of their experience in route selling.

Employment Outlook

The total number of route drivers is expected to change little through the mid-1980's. Some openings for new workers will arise, however, as experienced route drivers transfer to other fields of work, retire, or die. Applicants with sales experience and good driving records have the best chance of being hired.

Most job opportunities will be in wholesale routes. Since most route driver jobs currently are in wholesale routes, openings due to turnover will be higher on these routes than in retail ones. In addition, employment of retail route drivers is expected to continue to decline, further limiting opportunities.

Earnings and Working Conditions

Most route drivers receive a minimum salary plus a percent of the sales they make. Thus, earnings are strongly affected by an individual's selling ability, initiative, and the relationship he or she establishes with customers. Wholesale route drivers who make deliveries to stores usually earn more than those who make deliveries to homes.

Retail route drivers in the dairy industry employed in large cities had estimated weekly earnings, including commissions, of $268 in 1976. Those on wholesale routes earned $320 per week. Route drivers in the baking and beverage industries were paid weekly wages averaging $180 plus commissions, according to information from a limited number of union contracts.

The number of hours worked by route drivers varies. Some work only about 30 hours a week; others may work 60 hours or more depending upon whether they have well-established routes or are trying to build up new ones, and how ambitious they are. The number of hours worked may be limited by a union contract, although many contracts merely specify the earliest hour that work may begin and the latest quitting time. The hours also may vary with the season. During the spring-cleaning season, for example, drycleaning route drivers may work about 60 hours a week, but in winter they may work less than 30 hours.

Many companies require route drivers to wear uniforms. Some employers pay for the uniforms and for keeping them clean. For many route drivers, the fact that they do not work under close supervision is an attractive part of the job. Within certain broad limits, they decide how rapidly they will work and where and when they will have a lunch or rest period. A less desirable characteristic is that route drivers have to make deliveries in bad weather and do a great deal of lifting, carrying, and walking. They also may have to work unusual hours. For example, drivers who have retail milk routes generally start to work very early in the morning.

Many route drivers, particularly those who deliver bakery and dairy products, are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America. Some belong to the unions which represent the plant-workers of their employers.

Sources of Additional Information

For details on route driver employment opportunities, contact local employers, such as bakeries, laundry and linen supply companies, and vending machine companies, or the local office of the State employment service.

SECURITIES SALES WORKERS

(D.O.T. 251.258)

Nature of the Work

When investors want to buy or sell stocks, bonds, or shares in mutual funds, they call on securities sales workers to put the "market machinery" into operation. Both the individual who invests a few hundred dollars and the large institution with millions to invest need such services. Often these workers are called *registered representatives*, *account executives*, or *customers' brokers*.

In initiating "buy" or "sell" transactions, securities sales workers relay orders through their firms' offices to the floor of a securities exchange. When the security is traded in the over-the-counter market instead, they send the order to the firm's trading department. In either case, the sales worker promptly notifies the customer of the completed transaction and the final price.

In addition, they provide many related services for their customers. They may explain to new investors the meaning of stock market terms and trading practices; offer the client complete financial counseling; devise an individual financial portfolio including securities, life insurance, and other investments for the customer; and advise on the purchase or sale of a particular security. Some individuals may prefer long-term investments designed for either capital growth or income over the years; others might want to invest in short-term securities that hopefully will rise in price quickly. Securities sales workers furnish information about the advantages and disadvantages of each type of investment based on each person's objectives. They also supply the latest stock and bond quotations on any security in which the investor is interested, as well as information on the activities and financial positions of the corporations these securities represent.

Securities sales workers may serve all types of customers or they may specialize in one type only, such as institutional investors. They also may specialize in handling only certain kinds of securities such as mutual funds. Some handle the sale of "new

Beginning securities sales workers spend much of their time searching for customers.

issues," such as corporation securities issued for plant expansion funds.

Beginning securities sales workers spend much of their time searching for customers. Once they have established a clientele, however, they put more effort into servicing existing accounts and less into seeking new ones.

Places of Employment

About 90,000 persons sold securities full time in 1976. It is estimated that an additional 100,000 persons sold securities less than full time. These include partners and branch office managers in securities firms, insurance agents and brokers offering securities to their customers, and part-time mutual fund representatives.

Securities sales workers are employed by brokerage firms, investment bankers, and mutual funds in all parts of the country. Many of these firms are very small. Most sales workers, however, work for a small number of large firms with main offices in big cities (especially in New York) or the approximately 6,000 branch offices in other areas.

Training, Other Qualifications, and Advancement

Because a securities sales worker must be well informed about economic conditions and trends, a college education is increasingly important, especially in the larger securities firms. This is not true, however, for part-time work selling mutual funds. Although employers seldom require specialized training, courses in business administration, economics, and finance are helpful.

Almost all States require persons who sell securities to be licensed. State licensing requirements may include passing an examination and furnishing a personal bond. In addition, sales workers usually must register as representatives of their firms according to regulations of the securities exchanges where they do business or the National Association of Securities Dealers, Inc. (NASD). Before beginners can qualify as registered representatives, they must pass the Securities and Exchange Commission's General Securities Examination, or examinations prepared by the exchanges or the NASD. These tests measure the prospective representative's knowledge of the securities business. Character investigations also are required. Before securities sales workers can sell insurance, they must be licensed by the State in which they live.

Most employers provide training to help sales workers meet the requirements for registration. In member firms of all major exchanges the training period is at least 4 months. Trainees in large firms may receive classroom instruction in security analysis and effective speaking, take courses offered by schools of business and other institutions and associations, and undergo a period of on-the-job training. In small firms, and in mutual funds and insurance companies, training programs may be brief and informal. Beginners read assigned materials and watch other sales workers transact business.

Many employers consider personality traits as important as academic training. Employers seek applicants who are well groomed, able to motivate people, and ambitious. Because maturity and the ability to work independently also are important, a growing number of employers prefer to hire those who have achieved success in other jobs. Successful sales or managerial experience is very helpful to an applicant.

The principal form of advancement for securities sales workers is an increase in the number and the size of the accounts they handle. Although beginners usually service the accounts of individual investors, eventually they may handle very large accounts such as those of banks and pension funds. Some experienced sales workers advance to positions as branch office managers, who supervise the work of other sales workers while executing "buy" and "sell" orders for their own customers. A few representatives may become partners in their firms or do administrative work.

Employment Outlook

The number of securities sales workers is expected to grow about as fast as the average for all occupations through the mid-1980's as investment in securities continues to increase. In addition to jobs resulting from growth, several thousand sales workers will be needed annually to replace those who die, retire, or transfer to other jobs. Replacement needs are relatively large, due to the competitive nature of the occupation. Many sales workers leave their jobs each year because they are unable to establish a successful clientele.

Employment of securities sales workers is expected to expand as economic growth and rising personal incomes increase the funds available for investment. Growth in the number of institutional investors will be particularly strong as more people purchase insurance; participate in pension plans; and contribute to the endowment funds of colleges and other nonprofit institutions. In addition, more workers will be needed to sell securities issued by new and expanding corporations and by State and local governments financing public improvements.

The demand for securities sales workers fluctuates as the economy expands and contracts. Thus, in an economic downturn, the number of persons seeking jobs may exceed the number of openings—sometimes by a great deal. Over the long run, however, job opportunities for securities sales workers are expected to be favorable. During severe slumps in market activity, job prospects and income stability will be greater for sales workers who are qualified to provide their clients with complete financial services than for those who rely strictly on commissions from stock transactions.

Mature individuals with successful work experience should find many job opportunities. Demand will be strongest for well-rounded persons who are willing to learn all aspects of the securities business. Those seeking part-time work will be limited to selling shares in mutual funds.

Earnings and Working Conditions

Trainees usually are paid a salary until they meet licensing and registration requirements. After registration, a few firms continue to pay a

salary until the new representative's commissions increase to a stated amount. The salaries paid during training usually range from $650 to $850 a month; those working for large securities firms may receive higher salaries.

After candidates are licensed and registered, their earnings depend on commissions from the sale or purchase of stocks and bonds, life insurance, or other securities for customers. Commission earnings are likely to be high when there is much buying and selling, and lower when there is a slump in market activity. Most firms provide sales workers with a steady income by paying a "draw against commission"—that is, a minimum salary based on the commissions which they can be expected to earn. A few firms pay sales workers only salary and bonuses that usually are determined by the volume of company business.

Earnings of full-time, experienced securities sales workers who service individual investors averaged about $25,000 a year in 1976, according to the limited data available. Those who service institutional accounts earned about $44,000. Full-time securities sales workers earn about three times as much as average earnings for nonsupervisory workers in private industry, except farming.

Securities sales workers usually work in offices where there is much activity. In large offices, for example, rows of sales workers sit at desks in front of "quote boards" that continually flash information on the prices of securities transactions. Although established sales workers usually work the same hours as others in the business community, beginners who are seeking customers may work longer. Some sales workers accommodate customers by meeting with them in the evenings or on weekends.

Sources of Additional Information

Further information concerning a career as a securities sales worker is available from:

Securities Industry Association, 20 Broad St., New York, N.Y. 10005. (There is a $1 charge for this material.)

Career information also may be obtained from the personnel department of individual securities firms.

TRAVEL AGENTS

(D.O.T. 242.368)

Nature of the Work

Making travel arrangements can be frustrating and time consuming. Many travelers, therefore, seek the assistance of travel agents—specialists who have the information and ability to make the best possible travel arrangements, considering the tastes, budgets, and demands of the customer.

Consider the contrast between a corporate executive planning a business trip and a family of four on a restricted budget, both wanting to visit the Virgin Islands. The executive might want first-class air transportation, a luxurious suite upon arrival, and the use of a limousine. The agent would make the proper arrangements, and perhaps send the bill to the executive's company. On the other hand, the travel agent would advise the family about less expensive summer rates and special air fares. The agent would discuss the wide range of hotel costs and facilities and would try to arrange the most economical trip for that particular family. The agent would also inform the family of the island's climate, arrange for a car rental or escorted sightseeing excursions, and suggest local tourist attractions, as well as places to dine. For international travel, the agent would provide both the family and the executive with information on customs regulations, required papers (passports, visas, and certificates of vaccination) and the most recent currency exchange rates.

In making such arrangements, travel agents consult fare schedules published by regulatory bodies, such as the Civil Aeronautics Board and the International Air Transport Association. They also refer to guides and fact sheets for hotel ratings and other tourist information. Many travel agents base recommendations on their own travel experience.

Travel agents in business for themselves also must do considerable promotional work. They may give slide or movie presentations to social and special interest groups, arrange advertising displays, and meet with business managers to suggest company-sponsored trips.

Places of Employment

In 1976, about 15,000 persons in over 6,000 independent agencies worked as travel agents throughout the United States.

Though travel agents work in every part of the country, they are concentrated in major population centers, where the best business opportunities exist. About one-half of all travel agencies are located in large cities; one-third in suburban areas, and one-fifth in small towns and rural areas.

Roughly one-fourth of all travel agents are self-employed. Generally, these persons gained experience and recognition by working in an established travel agency before going into business for themselves.

Training, Other Qualifications, and Advancement

Students can prepare for careers as travel agents by working part time or during summers as reservation clerks or receptionists in travel agencies. As they become more experienced, they may enter either a formal or informal training program given by the agency, take on greater responsibilities, and eventually assume the full workload of a travel agent. Experience as an airline ticket clerk also is a good background for a travel agent.

Several home-study courses provide a basic understanding of the travel industry. An advanced course, leading to the designation of Certified Travel Counselor, is offered by the Institute of Certified Travel Agents to foster professionalism in the travel industry. This course is offered only to experienced travel agents.

Although few college courses relate directly to the travel industry, a college education is sometimes preferred by employers. A student preparing for a career as a travel agent

Broad travel experience is an important qualification for travel agents.

should study geography, foreign languages, and history. Accounting and business management would also be important for those anticipating starting their own travel agencies.

Broad travel experience is another important qualification for a career as a travel agent. The ability to speak of personal experiences frequently helps to influence customers' travel plans.

As a sales representative, the travel agent must have a pleasant personality and much patience. Agents often must demonstrate their efficiency and responsibility to hard-to-please customers.

Travel agents who anticipate starting their own agencies must gain formal conference approval before they can receive commissions. Conferences are simply organizations of airlines, shiplines or rail lines; the International Air Transport Association, for example, is the conference of international airlines. To gain conference approval, the owner of an agency must show that the agency is in operation and financially sound. In addition, the agency must generally employ at least one experienced travel agent who can arrange foreign and domestic travel, as well as hotel, resort, and sightseeing accommodations.

Since conference approval can take up to a year or more to obtain, most self-employed agents make very little profit in their first year. Their income generally is limited to commissions from hotels and tour operators and to the nominal fees that they may charge for making complicated arrangements. For those considering starting their own agency, the American Society of Travel Agents suggests a minimum of $20,000 in working capital, or enough to carry the agency through a profitless first year.

Currently, there are no Federal licensing requirements for travel agents. However, because of pending legislation, the licensing of travel agents may become required by several States in the near future.

Employment Outlook

Although the travel industry is expected to expand rapidly, competition for openings in travel agencies is expected to be keen through the mid-1980's. Even now, the number of people seeking work as travel agents is much greater than the number of jobs available. Moreover, since the industry generally is very sensitive to the fluctuations of the economy, opportunites at any given time depend heavily upon whether or not people can afford to travel. For example, travel spending decreased significantly during the 1973-74 Arab oil embargo, when the price of gasoline increased rapidly.

Despite economic fluctuations, spending on travel is expected to increase significantly through the mid-1980's. Rapidly increasing travel-related expenditures (mainly for air transportation and lodging) reflect Americans' rising incomes and increasing emphasis on leisure time activities. More people are expected to travel—and do so more frequently—than in the past, and more travel agents will be needed to handle this extra business.

Travel should increase because earlier retirement and longer vacations qive people more free time. The use of larger, more efficient planes, especially for trips to other countries, has brought air transportation within the budget of many Americans. By chartering an airplane and booking a large number of rooms at its destination, a group can save substantially over the cost of individual arrangements. Group tours, therefore, have made international travel possible for many who otherwise could not afford it.

In addition, the United States hosts more and more foreign visitors each year. American travel agents often organize tours for these visitors.

Earnings and Working Conditions

Earnings of travel agents who own their own agencies depend mainly upon commissions received from airlines and other carriers, tour operators, and lodging places. Commissions for domestic travel arrangements range from 5 to 10 percent; for cruises, about 10 percent; for hotels, sightseeing tours, and car rentals, 10 percent; and for international travel, about 7 percent. When travel agents arrange individual plans that require several connections and lodging reservations, they generally charge the customer a service fee to cover the time and expense involved in making the arrangements. For many services, however, commissions constitute the agent's only compensation.

During the first year or two, while awaiting conference approval and the payment of commissions, self-employed travel agents generally have very low earnings. Even established agents experience less profitable years during periods of economic downturn.

Experience, sales ability, and the size of the agency determine the salary of an employee in a travel agency. Salaries of travel agents generally ranged from $9,000 to $14,000 a year in 1976. Salaried agents usually

have standard fringe benefits—pension plans, insurance coverage, paid vacations—that self-employed agents must provide for themselves.

Travel agents frequently travel at substantially reduced rates. Sometimes a hotel or resort will offer a travel agent a free holiday.

Travel agents do not, however, spend most of their time traveling and vacationing. Most of the agent's time is spent behind a desk conferring with customers, completing necessary paper work, and contacting airlines and hotels for travel arrangements. Many agents, especially those who are self-employed, frequently work overtime.

Sources of Additional Information

For further information on a career as a travel agent, contact:

American Society of Travel Agents, 360 Lexington Ave., New York, N.Y. 10017.

WHOLESALE TRADE SALES WORKERS

(D.O.T. 260. through 289.458)

Nature of the Work

Sales workers in wholesale trade play an important role in moving goods from the factory to the consumer. Each sales worker may represent a wholesaler that distributes hundreds of similar products. A wholesale drug company, for example, may stock its warehouse with many brands of drugs, soap, and cosmetics to supply stores that sell directly to the consumer. Likewise, a wholesale building materials distributor sells hardware and construction materials to builders who would otherwise have to deal with many manufacturers.

At regular intervals, sales workers visit buyers for retail, industrial, and commercial firms, as well as buyers for institutions such as schools and hospitals. They show samples, pictures, or catalogs that list the items which their company stocks. Sales workers seldom urge customers to purchase any particular product, since they handle a large number of items. Instead, they offer prompt, dependable service so buyers will become regular customers.

Wholesale sales workers perform many important services for retailers, such as checking the store's stock and ordering items that will be needed before the next visit. Some wholesale sales workers help store personnel improve and update systems for ordering and inventory. In addition, they often advise retailers about advertising, pricing, and arranging window and counter displays. A sales worker who handles specialized products, such as air-conditioning equipment, may give technical assistance on installation and maintenance.

Sales workers do some recordkeeping and attend to other details. They must forward orders to their wholesale houses, prepare reports and expense accounts, plan work schedules, draw up lists of prospects, make appointments, and study literature relating to their products. Some collect money for their companies.

Places of Employment

About 808,000 persons were employed as wholesale sales workers in 1976. Wholesale houses usually are located in cities, but sales workers may be assigned territories in any part of the country. Their territory may cover a small section of a city having many retail stores and industrial users; in less populated regions it may cover half a State or more.

Firms selling machinery and building materials to industrial and business users are leading employers of wholesale sales workers. Other large employers are companies that sell food products. Wholesalers dealing in drugs, dry goods and apparel, motor vehicle equipment, and electrical appliances employ many sales workers as well.

Training, Other Qualifications, and Advancement

The background a sales worker needs depends mainly upon the product line and the market. Selling certain products requires extensive technical training. Drug wholesalers, for example, must know the names and characteristics of the pharmaceutical products they sell. A background in chemistry, biology, or pharmacy would prove useful, if not indispensable. In other product lines, such as food, familiarity with manufacturers and brands becomes much more important than knowledge about the product itself.

Product knowledge is not enough, however, when the sales person has to stimulate demand. Those selling electrical machinery to industrial firms, for example, must have the technical training necessary to discuss their products. But they also must understand how customers operate, what equipment they need, and how they might use their machines in new ways. The greater this understanding, the more machinery they will sell.

Most wholesale sales workers enter their occupation via one of two routes—working up the ladder or transferring in with the appropriate background. High school graduates may begin a career with a wholesale firm in a nonselling job or may be hired as a sales trainee. In either case, beginners usually work in several kinds of nonselling jobs before being assigned to sales. They may start in the stockroom or shipping department to become familiar with the thousands of items the wholesaler carries. Later they may learn the prices of articles and discount rates for goods sold in quantities. Next, they are likely to work on "inside" sales, writing telephone orders. Later, as they accompany an experienced sales worker on calls, trainees come to know some of the firm's customers. The time spent in these initial jobs varies among companies, but usually it take 2 years or longer to prepare trainees for outside selling.

As professionalism grows in wholesale trade and as products become increasingly complex, more and more college graduates enter the sales force directly out of school. Competent sales workers also transfer from manufacturing and retail trade sales positions. Their experience with a particular product line gives them an advantage over the newcomers to the field.

Sales trainees in very large wholesale firms participate in formal training programs that combine classroom instruction with short rotations in various nonselling jobs. Most firms, however, have no formal program. Their trainees learn by observing and trying the different aspects of the work. As they become familiar with customers and procedures, they gradually take on the full responsibility of the job.

Sales workers sometimes can augment their on-the-job training with outside programs. While only a few colleges offer courses relevant to wholesale distribution, the number is expected to increase. Trade associations sponsor training programs to fill this need. Vendors, too, hold sessions, usually to instruct sales people how best to sell a particular product line.

Experienced sales workers who have leadership qualities and sales ability may advance to supervisor, sales manager, or other executive positions.

Employment Outlook

Employment opportunities for sales workers in wholesale trade are expected to be good for those with product knowledge and selling ability. In addition to new positions created by growth, many openings will stem from turnover, which is fairly high in this occupation. A person's success in selling greatly depends on his or her ability to locate new customers and persuade them to buy. A number of new sales workers find they are not suited to the competitive nature of selling and leave the occupation.

The number of wholesale sales workers is expected to grow about as fast as the average for all occupations through the mid-1980's. Businesses and institutions will require a wide variety of products for their own use and for eventual resale. Although many large purchasers and others who require highly specialized products will buy directly from manufacturers, the majority of transactions will involve the wholesale distributor.

As chain stores and other large firms centralize purchasing activities, the value of the sales made to individual customers becomes larger and competition for sales correspondingly greater. Wholesalers can be expected to meet this competition by emphasizing customer services and increasing the size of their sales forces.

Earnings and Working Conditions

According to limited information, most beginning sales workers earned around $9,500 a year in 1976. Experienced sales workers earned considerably more. Since commissions often make up a large proportion of the sales worker's income, earnings vary widely in this occupation. They also depend on the sales worker's experience and seniority, as well as on the product line. Median earnings of the lowest paid sales workers in 1976 varied from $12,000 in automative parts and supplies to $18,400 in paper and paper products distribution. Median earnings of the highest paid sales workers ranged from $20,400 in beverage distribution to over $80,000 in paper and paper products.

Compensation plans differ among firms. Many employers pay a salary plus a percentage commission on sales; others pay a straight commission or straight salary. Some include a bonus. Although most wholesale sales workers have steady, year-round work, sales (and commissions) vary because demand for some products—for example, air-conditioning—is greater during certain seasons. To provide sales workers with a steady income, many companies pay experienced personnel a "draw" against annual commissions. Most companies furnish cars or allowances for cars and reimbursements for certain expenses on the road.

Sales workers often have long, irregular work hours. Although they call on customers during business hours, they may travel at night or on weekends to meet their schedule. However, most sales workers seldom are away from home for more than a few days at a time. They may spend evenings writing reports and orders, may carry heavy catalogs and sample cases, and be on their feet for long periods.

Depending on length of service, most sales workers have a 2- to 4-week paid vacation. Many are covered by company benefits, including health and life insurance and retirement pensions.

Sources of Additional Information

Information on jobs in wholesale selling may be obtained directly from local wholesale houses or from associations of wholesalers in many of the larger cities. If no local association is available, write to:

National Association of Wholesaler-Distributors, 1725 K St. NW., Washington, D.C. 20006.

Sales and Marketing Executives International, Career Education Division, 380 Lexington Ave., New York, N.Y. 10017.

CONSTRUCTION OCCUPATIONS

Construction craft workers represent the largest group of skilled workers in the Nation's labor force. Altogether, there were 3.3 million employed in 1976—about 3 out of every 10 skilled workers.

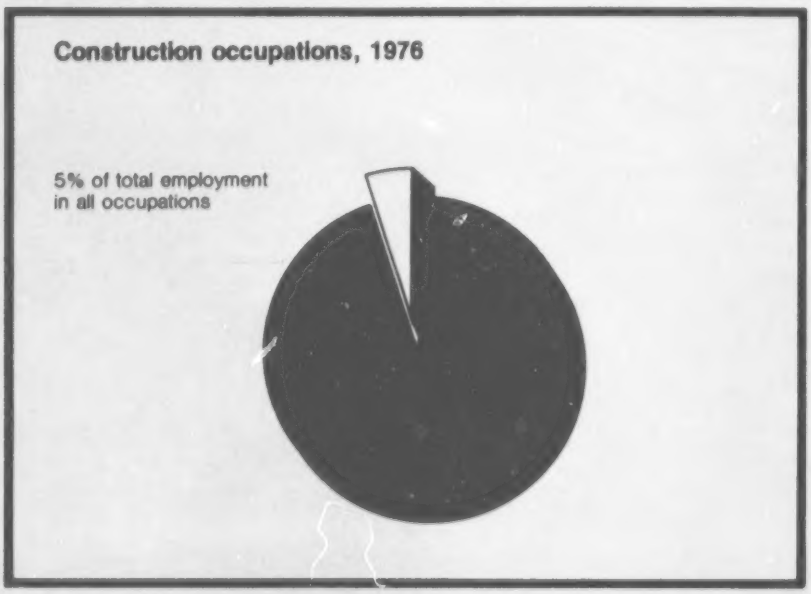
The more than two dozen skilled construction trades vary greatly in size. Several major trades—carpenter, painter, operating engineer, plumber, and electrician—each had more than 200,000 workers; carpenters alone numbered more than 1 million, about one-third of all construction craft workers. In contrast, only a few thousand each were employed in trades such as marble setter, terrazzo worker, and stonemason.

What are the Construction Trades?

Workers in the construction trades build, repair, and modernize homes and all kinds of buildings. They also work on a variety of other structures, including highways, airports, and missile launching pads.

Construction work may be divided into three categories: structural, finishing, and mechanical. In general, each trade falls in one of these categories: *Structural work*: Carpenter, operating engineer (construction machinery operator), bricklayer, iron worker, cement mason, stonemason, and boilermaker. *Finishing work*: Lather, plasterer, marble setter, terrazzo worker, painter, paperhanger, glazier, roofer, floor covering installer, and insulation worker. *Mechanical work*: Plumber, pipefitter, construction electrician, sheetmetal worker, elevator constructor, and millwright.

Most construction trades are described individually later in this chapter. Boilermakers and millwrights are described elsewhere in the *Handbook*.



Places of Employment

Most jobs are with contractors in the construction industry. The vast majority of construction contractors are small—generally employing fewer than 10 people. A few large contractors, however, employ thousands. Large numbers of construction trade workers are employed in other industries, such as mining and manufacturing, mainly to do maintenance and repair work. Chemical manufacturers, for example, need plumbers and pipefitters to maintain the complex pipe networks in their processing plants. Government agencies employ construction trade workers to maintain highways, buildings, and sanitation systems.

Many construction trade workers are self-employed and contract with homeowners and businesses for small jobs. Self-employment is most common in paperhanging, painting, and floor covering work, but it also is found in other trades.

Employment in the construction trades is distributed geographically in much the same way as the Nation's population. Thus, the highest concentration generally is in industrialized and highly populated areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend formal apprenticeship training as the best way to acquire the all-round skills in the construction trades. Apprenticeship is a prescribed period of on-the-job training, supplemented by related classroom instruction that is designed to familiarize apprentices with the materials, tools, and principles of their trade. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Although apprenticeship provides the most thorough training, many people acquire construction skills informally by working as laborers and helpers and observing experienced craft workers. Some acquire skills by attending vocational or trade schools or by taking correspondence school courses.

Apprentices generally must be at least 18 years old and in good physical condition. A high school or vocational school education, or its equivalent, including courses in mathematics and mechanical drawing, is desirable. Courses in construction trades, such as carpentry and electricity, also are recommended. Often, applicants are given tests to determine their aptitudes. For some trades, manual dexterity, mechanical aptitude, and an eye for proper alignment of materials are important.

The formal apprenticeship agreement generally calls for 3 to 4 years of on-the-job training and 144 hours or more of related classroom instruction each year. On the job, most instruction is given by a particular craft worker to whom the apprentice is assigned.

Classroom instruction varies among the construction trades, but usually includes courses such as history of the trade, characteristics of materials, shop mathematics, and basic principles of engineering.

In most communities, the apprenticeship programs are supervised by joint apprenticeship committees composed of local employers and local union representatives. The committee determines the need for apprentices in the community and establishes minimum standards of education, experience, and training. Whenever an employer cannot provide all-round instruction or relatively continuous employment, the committee transfers the apprentice to another employer. Where specialization by contractors is extensive—for instance, in electrical work—customarily the committee rotates apprentices among several contractors at intervals of about 6 months.

In areas where these committees have not been established, the apprenticeship agreement is solely between the apprentice and the employer or employer group. Many people have received valuable training under these programs but they have some disadvantages. No committee is available to supervise the training offered and settle differences over the terms and conditions of training. What the apprentice learns depends largely on the employer's business prospects and policies. If the employer lacks continuous work or does only a restricted type of work, the apprentice cannot develop all-round skills.

In many localities, craft workers—most commonly electricians and plumbers—are required to have a license to work at their trade. To qualify for these licenses, they must pass an examination to demonstrate a broad knowledge of the job and of State and local regulations.

Construction trades craft workers may advance in a number of ways. Many become supervisors. In most localities, small jobs are run by "working supervisors" who work at the trade along with members of their crews. On larger jobs, the supervisors do only supervisory work. Craft workers also can become estimators for contractors. In these jobs, they estimate material requirements and labor costs to enable the contractor to bid on a particular project. Some craft workers advance to jobs as superintendents on large projects. Others become instructors in trade and vocational schools or sales representatives for building supply companies. A large number of craft workers have become contractors in the homebuilding field.

Starting a small contract construction business is easier than starting a small business in many other industries. Only a moderate financial investment usually is needed, and it is possible to conduct a fairly substantial business from one's home. However, the contract construction field is very competitive, and the rate of business failure is high among small contractors.

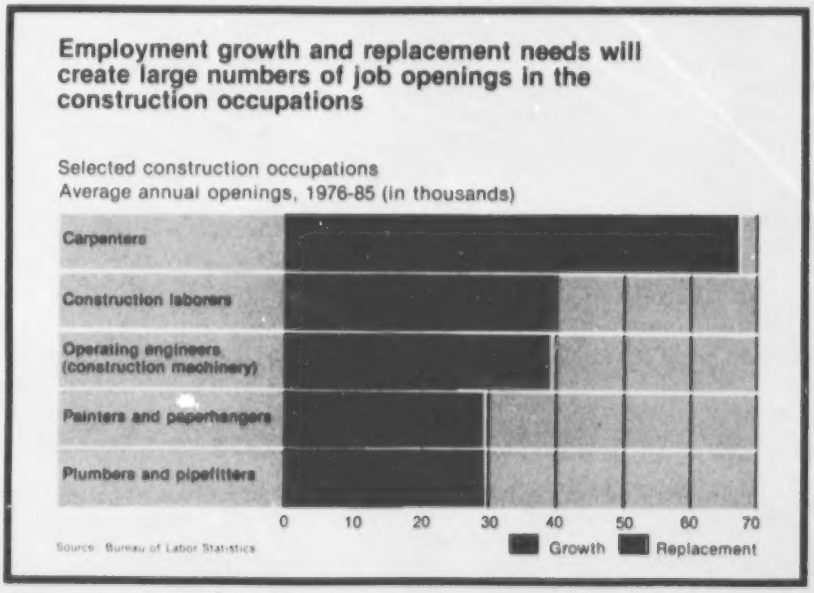
Employment Outlook

Employment in the construction trades is expected to increase faster than the average for all occupations through the mid-1980's. In addition to employment growth, many job openings will result each year from the need to replace experienced workers who transfer to other fields of work, retire, or die.

However, since construction activity is sensitive to changes in the Nation's economy, the number of openings may fluctuate sharply from year to year.

Over the long run, construction activity is expected to grow substantially. The anticipated increases in population and households, and the

Employment growth and replacement needs will create large numbers of job openings in the construction occupations



relatively low level of housing construction in the early 1970's, are expected to create strong pressure for new housing. Among other factors that will stimulate construction activity are higher levels of personal income and a rise in spending for new industrial plants and equipment. Also, there will be a growing demand for alteration and modernization work on existing structures, as well as for maintenance and repair work on highway systems, dams, bridges, and similar projects.

The increase in employment is not expected to be as great as the expansion in construction activity. Continued technological developments in construction methods, tools and equipment, and materials will raise output per worker. One important development is the growing use of prefabricated units at the job site. For example, preassembled outside walls and partitions can be lifted into place in one operation.

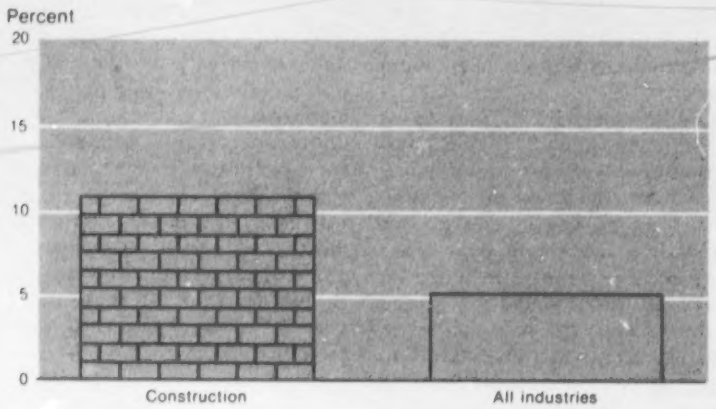
The rates of employment growth will differ among the various construction trades. Employment growth is expected to be fastest for cement masons and for insulation workers. Trades that will have the slowest growth rates are plasterers and sheetmetal workers.

Earnings and Working Conditions

Average hourly wage rates of unionized workers in the construction trades are about twice the hourly wage rate for nonsupervisory and production workers in private industry, except farming. Wage rates for apprentices usually start at 50 percent of the rate paid to experienced workers and increase at 6-month to 1-year intervals until the full rates are achieved upon the completion of training. The following table shows union hourly averages for selected construction trades in large cities surveyed in 1976.

	Hourly rate
Plumbers	$10.47
Electricians	10.33
Bricklayers	9.91
Carpenters	9.84
Plasterers	9.48
Painters	9.24

Unemployed rates: Construction and all industries, average 1948-76



Except for a few trades such as electricians, elevator constructors, plumbers and pipefitters, yearly earnings for experienced workers and their apprentices generally are lower than hourly rates would indicate because the number of hours that they work a year can be adversely affected by poor weather and fluctuations in construction activity.

Traditionally, winter is the slack period for construction activity, particularly in colder regions. Some workers, such as laborers and roofers, may not work for several months. However, not only cold but also rain may slow—even stop—work on a construction project. Also, because the construction trades are so dependent on one another—particularly on large projects—work delays or strikes in one trade can delay or stop the work of another. The accompanying chart shows that the unemployment rate in the construction industry is about twice that of workers as a whole.

Construction work frequently requires prolonged standing, bending, stooping, and working in cramped quarters. Exposure to weather is common since much of the work is done outdoors or in partially enclosed structures. Many people prefer construction work because it permits them to be outdoors.

Because construction workers may need to work with sharp tools, amidst the clutter of materials, while standing on temperary scaffolding, and in bad weather, they are more prone to injury than workers in other jobs. Indeed, the construction industry has the highest injury and illness rate of all industries. However, employers increasingly are placing an emphasis on safe working conditions and are stressing safe work habits—practices that reduce the risk of injuries.

The construction trades offer especially good opportunities for young people who are not planning to go to college, but who are willing to spend several years in learning a skilled occupation. Construction workers can find job opportunities in all parts of the country. Their hourly wage rates generally are much higher than those of most other manual workers. As previously noted, construction trade workers with business ability have greater opportunities to open their own businesses than workers in most other skilled occupations.

A large proportion of construction workers are members of trade unions affiliated with the Building and Construction Trades Department of the AFL-CIO.

Sources of Additional Information

Information about opportunities for apprenticeship or other training can be obtained from local construc-

tion firms and employer associations, the local office of the State employment service or State apprenticeship agency, or the local office of the Bureau of Apprenticeship and Training, U.S. Department of Labor. Many apprenticeship programs are supervised by local union-management committees. In these instances, an apprentice applicant may apply directly to the coordinator of the committee.

For additional information on jobs in the construction trades, contact:

American Federation of Labor and Congress of Industrial Organizations, Building and Construction Trades Department, 815 16th St. NW., Washington, D.C. 20006.

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

National Association of Home Builders, 15th and M Sts. NW., Washington, D.C. 20005.

For the names of labor organizations and trade associations concerned with specific trades, see the discussions of individual building trades that follow.

BRICKLAYERS, STONEMASONS, AND MARBLE SETTERS

(D.O.T. 861.381 and .781)

Nature of the Work

Bricklayers, stonemasons, and marble setters work in closely related trades, each producing attractive, durable surfaces. Bricklayers build walls, partitions, fireplaces, and other structures with brick, cinder block, and other masonry materials. They also install firebrick linings in industrial furnaces.

Stonemasons build stone walls as well as set stone exteriors and floors. They work with two types of stone—natural cut, such as marble, granite, and limestone; and artificial stone made from cement, marble chips, or other masonry materials. Because stone is expensive, stonemasons work mostly on high-cost buildings, such as offices, hotels, and churches.

Marble setters install marble which provides very decorative and highly durable surfaces. Marble setters, like stonemasons, work mostly on high-cost buildings. The marble they use usually is cut and polished before it is sent to the job site.

In putting up a wall, bricklayers first build the corners at each end of the wall, using plumblines and a level. A line then is stretched from corner to corner as a guide for each course or layer of brick. Bricklayers spread a bed of mortar (cement mixture) with a trowel (a flat metal tool), place the brick on the mortar bed, and then tap it into place. As blueprints specify, they cut bricks with a hammer and chisel to fit around windows, doors, and other openings. Mortar joints are finished with jointing tools to leave a neat and uniform appearance. Bricklayers also may weld metal supports for bricks.

Bricklayers are assisted by hod carriers, or helpers, who supply them with bricks and other materials, mix mortar, and set up and move scaffolding. (See the statement on construction laborers that appears elsewhere in the *Handbook*.)

Stonemasons often work from a set of drawings in which each stone has been numbered for identification. Helpers may locate and bring the prenumbered stones to the masons. A derrick operator using a hoist may be needed to lift large pieces into place.

When building a stone wall, masons set the first layer of stones into a shallow bed of mortar. They align the stones with plumblines and levels, and tap them into position with a wood mallet. Masons build the wall by alternating layers of mortar and stone. As the work progresses, they fill the joints between stones with mortar using a pointed metal tool to smooth the mortar to an attractive finish. To hold stones in place, stonemasons sometimes position pieces of metal within the wall by welding or bolting them together. After positioning the rocks, they cover the metal with mortar. Finally, for a clean appearance, masons wash the stone with a mild acid solution to remove dirt and dry mortar.

When setting stone floors, masons trowel a thin layer of mortar over the surface. They then hand set the stone in the mortar, leaving the surface of the stone exposed. To finish, workers trowel the joints and wash the stone.

To cut stone into various shapes and sizes, masons find the grain of each piece of stone and use a special hammer to strike it along a predetermined line. Valuable pieces often are cut with a saw that has a special blade.

About 1 out of 7 bricklayers, stonemasons, and marble setters is self-employed.

Setting marble is very much like setting stone. Marble setters prepare a fine mixture of cement, sand, and water—called mortar—then trowel a thin layer of it onto the surface. For floors and for walls where the holding strength of mortar alone is sufficient, setters—following instructions from blueprints—often hand set each marble piece into the mortar, leaving the face of the marble exposed. For heavy pieces, workers employ a hoist to lift and position the marble. To secure heavy pieces on walls, setters use bolts in addition to mortar. Once the marble pieces are positioned and secured, setters mortar and trowel the joints and clean the marble's surface.

In addition to construction work, marble setters do repair work. They fill and cover holes and cracks in marble with mortar prepared and finished to look like the marble. They also polish and replace marble. When pieces are too large, setters cut them to size using a special saw.

Bricklayers, stonemasons, and marble setters primarily use handtools—including trowels, brick and stone hammers, wood or rubber mallets, and chisels. For exacting cuts of brick, stone, or marble, they use high-powered electric saws equipped with special cutting blades.

Places of Employment

About 175,000 bricklayers, stonemasons, and marble setters were employed in 1976; most were bricklayers. Workers in these crafts were employed primarily by special trade, building, or general contractors. A relatively small number of bricklayers work for government agencies or businesses that do their own construction and alteration.

Workers in these trades are employed throughout the country, but are concentrated in metropolitan areas. In cities that are too small to have a demand for full-time stonemasons or marble setters, bricklayers will install stone or marble as a sideline.

About 1 out of 7 bricklayers, stonemasons, and marble setters is self-employed—a proportion higher than that in most building crafts. Many of the self-employed specialize in contracting on small jobs such as patios, walks, and fireplaces.

Training, Other Qualifications, and Advancement

Most bricklayers as well as some stonemasons and marble setters pick up their skills informally by working as helpers or hod carriers and by observing and learning from experienced workers. The remainder learn their skills through apprenticeship, which provides the most thorough training.

Individuals who learn the trade informally usually become bricklayers. They start with carrying materials, moving scaffolds, and mixing mortar. However, it takes several months to a year before they are taught to spread mortar and lay brick. They begin with simple patterns and progress to more complex designs. Learning to set stone or marble might take several years.

Apprenticeships for bricklayers, stonemasons, and marble setters usually are sponsored by local union-management committees. The apprenticeship program requires 3 years of on-the-job training, in addition to 144 hours of classroom instruction each year in subjects such as blueprint reading, mathematics, layout work, and sketching. Apprentices learn the general applications of brick, stone, and marble.

Apprentices start by carrying materials and mixing mortar. Within 2 or 3 months, they learn to align, lay, and clean brick. Apprentices eventually learn to work with stone and marble. After apprenticeship, they usually specialize in one of the three trades.

Applicants for apprenticeships must be at least 17 years old. Apprentice and helper applicants should be in good physical condition. A high school or vocational school education is preferable, as are courses in mathematics, mechanical drawing, and shop.

Experienced workers can advance to supervisory positions or become estimators. They also can open contracting businesses of their own.

Employment Outlook

Employment of bricklayers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to the job openings that result from employment growth, many openings will arise as experienced bricklayers retire, die, or leave the occupation for other reasons.

As population and business growth create a need for new homes, factories, offices, and other structures, the demand for bricklayers will grow. Stimulating this growth will be the increasing use of brick for decorative work on building fronts and in lobbies and foyers. The use of brick, particularly for interior load-bearing walls, is growing and will add to overall employment needs.

Over the long run, job openings for bricklayers are expected to be plentiful; however, the number of openings may fluctuate from year to year because employment in this trade is sensitive to ups and downs in construction activity. For any given year, opportunities usually are best during the spring and summer when construction activity picks up.

Employment of stonemasons and marble setters is not expected to change significantly through the mid-1980's. Stone and marble have lost popularity as building materials because they have become much more expensive than materials such as brick and concrete. Nevertheless, a small number of jobs will become available due to the need to replace stonemasons and marble setters who retire, die, or leave the occupations.

Earnings and Working Conditions

Hourly wage rates were $9.90 for bricklayers, $10.05 for stonemasons, and $9.60 for marble setters, according to a 1976 survey of union wage rates in metropolitan areas. These rates are about twice the average wage of nonsupervisory and production workers in private industry, except farming. However, yearly earnings for workers in these trades generally are lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

In each trade, apprentices start at about 50 percent of the wage rate

paid to experienced workers. The rate increases as they gain experience.

The work of bricklayers, stonemasons, and marble setters sometimes is strenuous because it involves moderately heavy lifting and prolonged standing and stooping. Most of the work is performed outdoors.

A large proportion of bricklayers, stonemasons, and marble setters are members of the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For details about apprenticeships or other work opportunities in these trades, contact local bricklaying, stonemasonry, or marble setting contractors; a local of the union listed above; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of either bricklayers or stonemasons, contact:

International Union of Bricklayers and Allied Craftsmen, International Masonry Apprenticeship Trust, 815 15th St. NW., Washington, D.C. 20005.

Information about the work of bricklayers also may be obtained from:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

Brick Institute of America, 1750 Old Meadow Rd., McLean, Va. 22101.

CARPENTERS

(D.O.T. 860.281 through .781)

Nature of the Work

Carpenters, the largest group of building trades workers, are employed in almost every type of construction activity. Their work is commonly divided into two broad categories—"rough" carpentry and "finish" carpentry. Skilled carpenters are able to do both types of work.

Carpenters build according to instructions obtained from supervisors, blueprints, or both. In rough work, they erect the wood framework in buildings, including subfloors, partitions, floor joists, and rafters. In addition, they install heavy timbers used in the building of docks, railroad trestles, and similar heavy installations. Rough carpentry also includes the building of forms to enclose concrete until it is hardened, the making of chutes for pouring concrete, and the erecting of scaffolds and temporary buildings on the construction site. In all cases, carpenters must use materials and building techniques that conform to local building codes.

In finish work, which begins after the rough work is complete, carpenters install molding, wood paneling, cabinets, window sash, door frames, doors, and hardware and complete other finish work. Finish carpentry also includes building stairs and laying floors. Carpenters who do finish work must consider the appearance as well as the structural accuracy of the work. For example, they use a mitre-box saw to cut moldings so joints will not be noticed, and hide nails or screws with putty for a neat appearance.

As part of their job, carpenters also saw, fit, and assemble plywood, wallboard, and other materials. They use nails, bolts, wood screws, or glue to fasten materials. They may also install linoleum, asphalt tile, and similar soft floor coverings. Carpenters use handtools such as hammers, saws, chisels, planes, and power tools such as portable power saws, drills, and rivet guns.

Because of the wide scope of work in the trade, carpenters tend to concentrate on only one type of work. For example, some carpenters specialize in erecting new houses; others specialize in laying hardwood floors. Specialization is more common in large metropolitan areas; in smaller communities and in rural areas, carpenters ordinarily do all types of carpentry and also may install glass, put in insulation, and paint.

Places of Employment

About 1,010,000 carpenters were employed in 1976, of whom about one in five was self-employed. Most carpenters work for contractors and homebuilders who construct new buildings and other structures or who alter, remodel, or repair buildings; some carpenters alternate between wage employment for contractors and self-employment on small jobs. Most other carpenters work for government agencies, utility companies, manufacturing firms, or other large organizations.

Carpenters work throughout the country and, because of their versatility, are much less concentrated geographically than any other construction occupation.

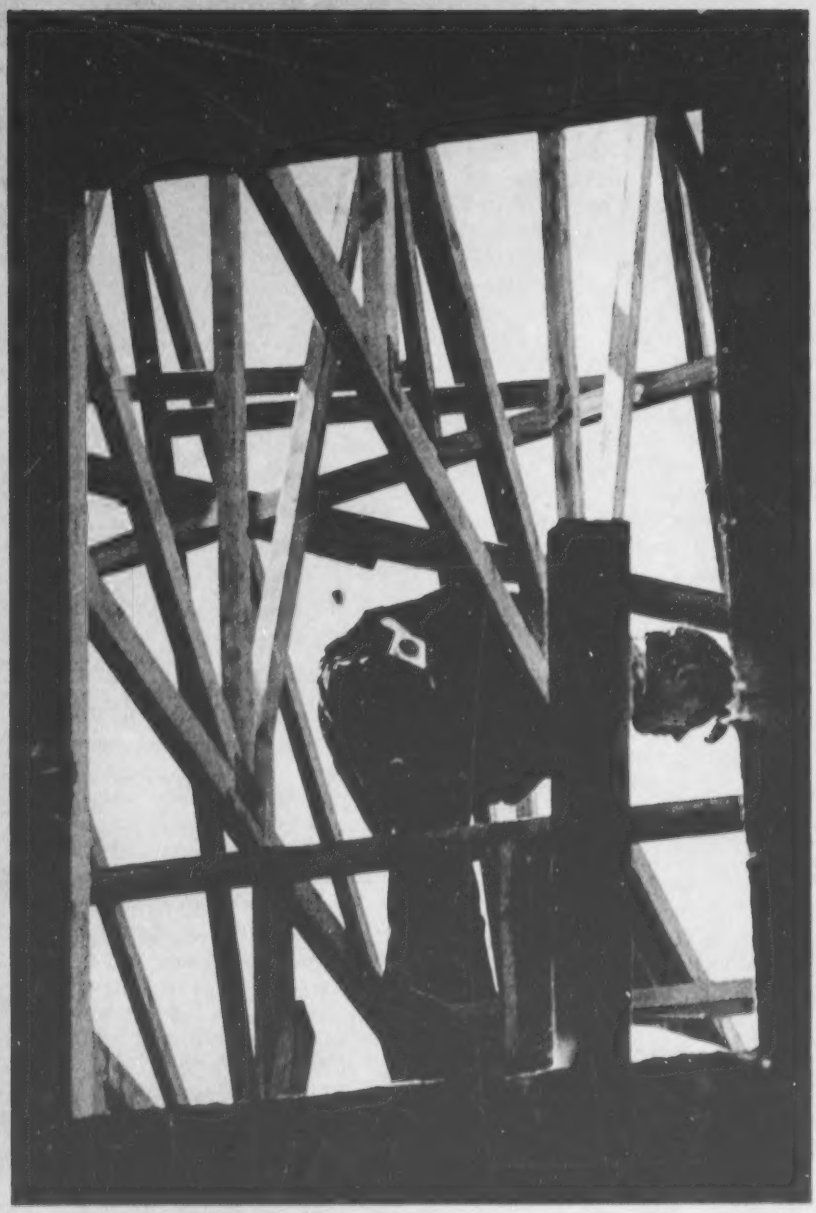
Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of an apprenticeship program as the best way to learn carpentry. A large number of workers in this trade, however, have acquired their skills informally (for example, by working as carpenters' helpers).

The apprenticeship program, sponsored by the local joint committee of contractors and unions, usually consists of 4 years of on-the-job training, in addition to a minimum of 144 hours of related classroom instruction each year. On the job, apprentices learn elementary structural design and become familiar with the common systems of frame and concrete form construction. They also learn to use the tools, machines, equipment, and materials of the trade. In addition, they learn the many carpentry techniques, such as laying out, form building, framing, finishing, and welding.

Apprentices receive classroom instruction in drafting and blueprint reading, mathematics for layout work, and the use of woodworking machines. Both in the classroom and on the job they learn the relationship between carpentry and the other building trades, because the work of the carpenter is basic to the construction process.

Other informal on-the-job programs are provided by local contractors and usually are shorter and less thorough than apprenticeships. The



Over 1 million workers are employed as carpenters.

degree of training and supervision in these programs depends principally on the size of the contractor. A small contractor who specializes in homebuilding may provide training in only one area—for example, rough framing. In contrast, a large general contractor may provide training in several areas.

Persons interested in carpentry should obtain the all-round training given in apprenticeship programs. Carpenters with such training will be in much greater demand and will have better opportunities for advancement than those who can do only the relatively simple, routine types of carpentry.

Apprenticeship applicants generally must be at least 17 years old. A high school or vocational school education is desirable, as are courses in carpentry, shop, mechanical drawing, and general mathematics. Good physical condition, a good sense of balance, and lack of fear of working on high structures are important assets. Applicants should also have manual dexterity and the ability to solve arithmetic problems quickly and accurately. In addition, they should be able to work closely with others. Required tests, designed to help measure an applicant's aptitude for carpentry, are given by local joint committees.

Carpenters may advance to carpenter supervisors or to general construction supervisors. Carpenters usually have greater opportunities than most other construction workers to become general construction supervisors since they are involved with the entire construction process. Some carpenters are able to become contractors and employ others.

Employment Outlook

Job opportunities for carpenters should be plentiful over the long run. Because of the large number of people employed in this field, replacement needs are high. Besides the job openings that result from the need to replace carpenters who retire, die, or leave their job for other reasons, many openings will be created by employment growth.

Employment of carpenters is expected to grow about as fast as the average for all occupations through the mid-1980's. Population and business growth will lead to a demand for more houses and other structures, thus increasing the demand for carpenters. More carpenters also will be needed for alteration and maintenance work. However, because construction activity is sensitive to ups and downs in the economy, the number of job openings may fluctuate greatly from year to year.

Earnings and Working Conditions

According to a survey of metropolitan areas in 1976, union wage rates for carpenters averaged $9.85 an hour, or about twice the average rate for production and nonsupervisory workers in private industry, except farming. Annual earnings, however, may not be as high as the hourly rates would indicate, because carpenters lose some worktime due to poor

weather and occasional unemployment between jobs.

Hourly wage rates for apprentices usually start at about 50 percent of the rate paid to experienced carpenters and increase by about 5 percent at 6-month intervals.

As in other building trades, the carpenter's work is active and sometimes strenuous, but exceptional physical strength is not required. However, prolonged standing, as well as climbing and squatting, often are necessary. Carpenters risk injury from slips or falls, from contact with sharp or rough materials, and from the use of sharp tools and power equipment. Many people like carpentry because they can work outdoors.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America.

Sources of Additional Information

For information about carpentry apprenticeships or other work opportunities in this trade, contact local carpentry contractors, a local of the union mentioned above, a local joint union-management apprenticeship committee, or the nearest office of the State employment service or State apprenticeship agency.

For general information on apprenticeship in this trade, contact:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

United Brotherhood of Carpenters and Joiners of America, 101 Constitution Ave. NW., Washington, D.C. 20005.

CEMENT MASONS AND TERRAZZO WORKERS

(D.O.T. 844.884, 852.884, and 861.781)

Nature of the Work

Cement masons mix, pour, and finish concrete for many types of construction projects. The projects range from finishing of small jobs, such as patios and floors, to work on huge dams and miles of concrete highways. On small projects, a mason, assisted by one or two helpers, may do all of the masonry work; on large projects, a crew of several masons and many helpers may be employed. Among other tasks, cement masons may color concrete surfaces, expose aggregate in walls and sidewalks, or fabricate concrete beams, columns, and panels.

Terrazzo workers create attractive walkways, floors, patios, and panels by exposing marble chips and other fine aggregates on the surface of finished concrete. However, much of the preliminary work of terrazzo workers is the same as that for cement masons.

In preparing a site for pouring concrete, cement masons make sure the forms for molding the concrete are set for the desired pitch and depth and are properly aligned. Masons direct the pouring of the concrete and supervise laborers who use shovels or special rakes to place and spread the concrete. Masons then guide a "straightedge" (a long, straight piece of wood or similarly shaped piece of metal) back and forth across the top of the forms to level the freshly poured concrete and to show low spots, where concrete is added and leveled again.

Immediately after leveling the cement, masons carefully press a "darby" (a long, straight 1 inch by 4 inch piece of wood with smooth, rounded edges and a handle) with sweeping motions over the surface of the concrete, forcing heavy particles under and smoothing the top.

After darbying, masons wait until heavy particles in the cement settle to the bottom and excess water works its way to the surface. When the excess water evaporates and the concrete is firm but workable, masons complete their work.

Finishers first press an edger gently between the forms and the concrete, and guide it carefully along the edge and the surface. This produces slightly rounded edges and helps prevent them from chipping or cracking.

For joints, finishers use a flat tool that has a smooth ridge protruding from the center. At specified markings, workers make joints or grooves that help prevent unsightly cracks on the surface.

Next, finishers rub a float—a small and smooth, rectangular piece of wood—over the entire surface, carefully avoiding edges and joints. Floating embeds the heavier material deeper into the concrete, removes most imperfections, and brings the lighter material—mortar—to the surface.

As the final step, masons sweep the mortar with a trowel (a flat, metal tool) back and forth over the surface to create a smooth finish. On some jobs, electrically powered trowels may be used.

Masons also produce other finishes. For a coarse, non-skid finish, masons brush the surface with a broom or stiff bristled brush. For a pebble-like finish, they embed gravel chips into the surface, leaving the tops of the chips exposed. They wash any excess cement from the exposed chips with a mild acid solution for a neat appearance. For color, they sprinkle on a dye which they brush and trowel into the surface.

For concrete surfaces, such as columns, ceilings, and wall panels, that will remain exposed after forms are stripped, concrete finishers locate and correct any defects. First, they chisel away high spots and loose cement and smooth them out with a rubbing brick. They then fill the defects with a rich cement mixture, and either float or trowel a smooth, uniform finish.

Some cement masons specialize in laying a mastic coat (a fine asphalt mixture) over concrete, particularly in buildings where sound-insulated or acid-resistant floors are specified.

Cement masons must know their materials and be familiar with various chemical additives which speed or slow the setting time. Because of the effects of heat, cold, and wind on the drying time of cement, masons must be able to recognize by sight and touch what is occurring in the cement mixture so that they can prevent structural defects.

Attractive, marble-chipped terrazzo requires three layers of materials. First, either cement masons or terrazzo workers build a solid, level concrete foundation that is 3 inches to 4 inches deep.

After the forms are removed from the foundation, workers apply a 1 inch deep mixture of sandy concrete. When this layer becomes tacky, terrazzo workers partially embed metal dividing strips into the concrete wherever there is to be a joint or change of color in the terrazzo. Before this layer dries, workers make sure the tops of the strips are level with one another. The ferrule strips become a network of rigid dividers for terrazzo panels, allowing for unique design and color variation between panels. They also help prevent cracks from developing in the finished terrazzo.

For the final layer, terrazzo workers blend a fine concrete mixture which may be color dyed. They pour this mixture into each of the panels, then hand trowel each panel until level with the tops of the ferrule strips. While the mixture is wet, workers toss marble chips of various colors into each of the panels. To completely embed the marble chips, workers roll a lightweight roller over the entire surface.

When the terrazzo is thoroughly dry, workers grind it with a terrazzo grinder(somewhat like a disc-type floor polisher, only much heavier). The surface is ground until even with the top of the ferrule strips. Pits and holes are filled and steel troweled for a smooth, level surface. When the surface is dry, terrazzo workers clean, polish, and seal it for a rich, lustrous finish.

Places of Employment

About 71,000 cement masons and terrazzo workers were employed in 1976. Cement masons work for general contractors who construct entire projects, such as highways or large buildings, and for contractors who do only concrete work. Some masons install composition resilient floors for specialty floor contractors. A small number of masons are employed by municipal public works departments, public utilities, and manufacturing firms that do their own construction work. Most terrazzo workers work for special trade contractors who install decorative floors and wall panels.

One out of 10 cement masons and terrazzo workers is self-employed, about the same proportion as in other building trades. Most masons specialize in small jobs, such as driveways, sidewalks, and patios; most terrazzo workers, in floors.

Training, Other Qualifications, and Advancement

Cement masons and terrazzo workers learn their trade either through on-the-job training as helpers or through 2-year or 3-year apprenticeship programs. About one-third of all cement masons worked as construction laborers before becoming cement masons.

On-the-job training programs, almost all of which are available to cement mason trainees, provide informal instruction from experienced workers. Helpers learn to handle the tools, equipment, machines, and materials of the trade. They begin with simple tasks, such as spreading and using a straightedge on freshly poured concrete. As they advance, assignments become more complex, and usually within a year helpers are doing finishing work.

Two-year and 3-year apprenticeship programs, usually sponsored by local union-contractor agreements, also provide on-the-job training in addition to 144 hours of classroom instruction each year. In the classroom, apprentices learn applied mathematics, blueprint reading, and safety. Three-year apprentices receive special instruction in layout work and estimating.

When hiring helpers and apprentices, employers prefer high school graduates who are at least 18 years old, in good physical condition, and licensed to drive. High school courses in shop mathematics and blueprint reading or mechanical drawing provide a helpful background.

Experienced cement masons or terrazzo workers may advance to supervisors or contract estimators, or may open concrete contracting businesses.

Cement masons must know their materials and be familiar with various chemical additives that speed or slow the setting time.

Employment Outlook

Employment of cement masons and terrazzo workers is expected to grow much faster than the average for all occupations through the mid-1980's. As population and the economy grow, more masons will be needed to help build apartments, offices, factories, and other structures. The greater use of concrete as a building material also will add to the demand for these workers. Prestressed concrete columns, for example, are being used increasingly in place of steel columns for large buildings. Besides the job openings created by employment growth, many openings will arise as experienced masons retire, die, or transfer to other fields of work. For terrazzo workers, most, if not all, openings will arise from replacement needs.

While the employment outlook is expected to be favorable over the long run, the number of job openings may fluctuate from year to year because construction activity is sensitive to ups and downs in the economy.

Earnings and Working Conditions

Union cement masons and terrazzo workers in metropolitan areas had estimated average wages of $9.35 an hour in 1976, about twice the average wage for nonsupervisory and production workers in private industry, except farming. Union masons generally have higher wage rates than nonunion masons. Apprentices usually start at 50 to 60 percent of the rate paid to experienced cement masons or terrazzo workers.

Annual earnings for cement masons, terrazzo workers, and apprentices generally are lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. They often work overtime, because once concrete has been poured the job must be completed.

Mason or terrazzo work is active and strenuous. Since most finishing is done on floors or at ground level, workers must stoop, bend, and kneel. Because some jobs are outdoors, worktime is lost due to rain and freezing weather. In some cases, however, concrete and terrazzo can be poured year round by using heated, temporary shelters made of sheet plastic.

A large proportion of cement masons and terrazzo workers are union members. They belong either to the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or to the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For information about apprenticeships and work opportunities, contact local cement finishing contractors; locals of unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about cement masons and terrazzo workers, contact:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

International Union of Bricklayers and Allied Craftsmen, 815 15th St. NW., Washington, D.C. 20005.

Operative Plasterers' and Cement Mason International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

CONSTRUCTION LABORERS

(D.O.T. 801.887, 809.887, 842.887, 844.887, 850.887, 851.887, 852.887, 853.887, 859.884 and .887, 860.884 and .887, 861.884 and .887, 862.884 and .887, 865.887, 866.887, 869.887, and 892.883)

Nature of the Work

Construction laborers work on all types of construction projects—houses, highways, dams, airports, missile sites. They are usually the first workers to arrive on a construction project—assisting in site preparation—and the last to leave. Laborers under the direction of other trade workers provide much of the routine physical labor on construction and demolition projects. They erect and dismantle scaffolding, set braces to support the sides of excavations, and clean up rubble and debris. Laborers also help unload and deliver materials, machinery, and equipment to carpenters, masons, and other construction workers.

On alteration and modernization jobs, laborers tear out the existing work. They perform most of the work done by wrecking and salvage crews during the demolition of buildings.

When concrete is mixed at the worksite, laborers unload and handle materials and fill mixers with ingredients. Whether the concrete is mixed on-site or hauled in by truck, laborers pour and spread the concrete and spade or vibrate it to prevent air pockets. In highway paving, laborers clean the right-of-way, grade and help prepare the site, and set the forms into which wet concrete is poured. They cover new pavement with straw, burlap, or other materials to keep it from drying too rapidly.

Some construction laborers have job titles that indicate the kinds of work they do. Bricklayers' tenders and plasterers' tenders, both commonly known as hod carriers, help bricklayers and plasterers by mixing and supplying materials, setting up and moving portable scaffolding, and providing many other services. Hod carriers must be familiar with the work of bricklayers and plasterers and know the materials and tools they use. Some hod carriers also help cement masons.

Another group of laborers, pipelayers, lay sewer and other large, nonmetal pipe and seal connections with concrete and other materials.

Recent years have seen much mechanization of the laborers' tasks. Thus, in their traditional work, laborers now may operate such things as motorized lifts and ditch-diggers of the "walk-behind" variety, various kinds of small mechanical hoists, as

Recent years have seen much mechanization of the laborers' tasks.

well as laser beam equipment to align and grade ditches and tunnels.

Although some construction laborers' jobs require few skills, many jobs require training and experience, as well as a broad knowledge of construction methods, materials, and operations. Rock blasting, rock drilling, and tunnel construction are examples of work in which "know-how" is important. Laborers who work with explosives drill holes in rock, handle explosives, and set charges. They must know the effects of different explosive charges under varying rock conditions to prevent injury and property damage. Laborers do almost all the work in the boring and mining of a tunnel, including operations that would be handled by workers in other trades if the job were located above ground.

Places of Employment

About 715,000 construction laborers were employed in 1976. Most of them worked for construction contractors, for State and city public works and highway departments, and for public utility companies.

Training, Other Qualifications, and Advancement

Little formal training is needed to get a job as a construction laborer. Generally, applicants must be at least 18 years old and in good physical condition. Most new employees transfer from other occupations, such as truckdriver, farm laborer, or janitor.

Beginners' jobs are usually of the simplest type, such as unloading trucks and digging ditches. As workers gain experience, job assignments become more complex.

Many tasks require skills too complex for on-the-job training. As a result, contractors and unions have established 4- to 8-week formal training programs in many States to teach basic construction concepts, safety practices, and machinery operation.

After several years of experience and training, many laborers advance to craft jobs, such as carpenter, bricklayer, or cement mason.

Employment Outlook

Employment of construction laborers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to openings created by occupational growth, job openings will result from the need to replace workers who retire, die, or leave the occupation for other reasons. On the average, tens of thousands of job openings will become available each year. Because employment of laborers is sensitive to the ups and downs in construction activity, however, the annual number of openings may fluctuate.

Over the long run, growth in population and economic activity will spur construction. Laborers will be needed to meet the demand for moving materials, mixing and pouring concrete, and helping craft workers, particularly on large projects such as dams, highways, high rise buildings, and bridges.

Earnings and Working Conditions

Union wage rates for construction laborers averaged $7.50 an hour in 1976, compared with $4.87 an hour for production and nonsupervisory workers in private industry, except farming.

Annual earnings for construction laborers generally are lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction.

Construction work is physically strenuous, since it requires frequent bending, stooping, and heavy lifting. Much of the work is performed outdoors. Many construction laborers are members of the Laborers' International Union of North America.

Sources of Additional Information

For information about work opportunities, contact local building or construction contractors, a local of the Laborers' International Union of North America, or the local office of the State employment service.

For general information about the work of construction laborers, contact:

Laborers' International Union of North America, 905 16th St. NW., Washington, D.C. 20006.

Laborers'-Associated General Contractors' Education and Training Program, 1730 Rhode Island Ave., Suite 909, Washington, D.C. 20036.

DRYWALL INSTALLERS AND FINISHERS

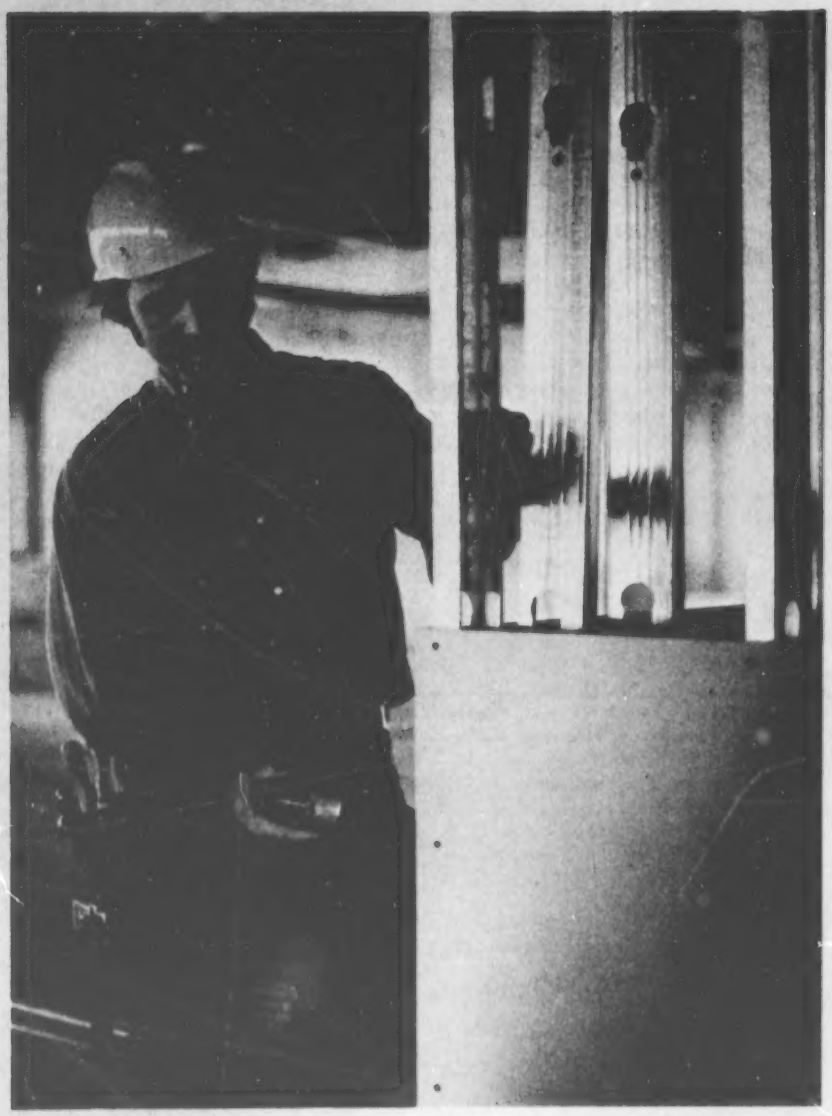
(D.O.T. 840.887 and 842.884)

Nature of the Work

Developed as a substitute for wet plaster, drywall consists of a thin wall of plaster sandwiched between two pieces of heavy paper. It is used today for walls and ceilings of most new homes because it saves both time and money compared to traditional construction using plaster.

Two new occupations have emerged in response to the widespread use of this construction material: drywall installers and drywall finishers. Installers fasten drywall panels to the framework inside houses and other buildings. Finishers do touchup work to get the panels in shape for painting.

Drywall panels are manufactured in standard sizes—for example, 4 feet by 12 feet. Thus, installers must mea-



High school courses in carpentry provide a helpful background for drywall work.

sure and cut some pieces to fit in small spaces, such as above and below windows. They also saw holes in the panels for electric outlets, air-conditioning units, and plumbing. After making these alterations, installers apply glue to the wooden framework, press the panels against it, and nail them down. An installer usually is assisted by a helper because large panels are too heavy and cumbersome for one person to handle.

Some installers specialize in hanging drywall panels on metal framework in offices, schools, and other large buildings. Following plans that indicate the location of rooms and hallways, they saw metal rods and channels to size, bolt them together to make floor-to-ceiling frames, and attach the drywall panels to the frames with screws. The workers also erect suspended ceilings. They hang metal bands from wires that are embedded in the concrete ceiling. The installers run the bands horizontally across the room, crisscrossing them to form rectangular spaces for the ceiling panels.

After the drywall has been installed, finishers fill joints between panels with a quick-drying paste. Using the wide, flat tip of a special knife, and brushlike strokes, they spread the paste into and along each side of the joint. Before the paste dries, workers use their knives to press a perforated paper tape into the paste and to scrape away excess paste. When the first application of paste is dry, finishers apply another to fill any depressions and to make a smooth surface. Nail and screw heads also are covered with this compound. Finishers sand these patched areas to make them as smooth as the rest of the wall surface. They also repair nicks and cracks caused by the installation of air-conditioning vents and other fixtures. Some finishers specialize in sanding, taping, or repair work.

Places of Employment

About 45,000 persons worked as drywall installers and finishers in 1976. Most worked for contractors that specialize in drywall construction; others worked for contractors that do all kinds of construction.

Installers and finishers are employed throughout the country, but are concentrated in urban areas. In many small towns, carpenters install drywall and painters finish it.

Training, Other Qualifications, and Advancement

Persons who become drywall installers or finishers usually start as helpers and learn most of their skills on the job. Some employers, in cooperation with unions, offer special programs which supplement on-the-job training with a few hours of classroom instruction each week. Each program lasts about 2 years.

Installer helpers start by carrying materials, holding panels, and cleaning up debris. Within a few weeks, they are taught to measure, cut, and install panels. Eventually, they become experienced installers, capable of working quickly and without help.

Finish helpers begin with taping joints and touching up nail holes and scratches. They soon learn to install corner guards and to conceal openings around pipes. Near the end of

their training, they learn to estimate costs of installing and finishing drywall.

Employers prefer high school graduates who are in good physical condition, but applicants with less education frequently are hired. High school or trade school courses in carpentry provide a helpful background for drywall work. Installers must be good at simple arithmetic.

After qualifying as an installer or finisher, a person who has leadership ability may become a supervisor within a few years. Some workers start their own drywall contracting businesses.

Employment Outlook

Employment of drywall workers is expected to grow much faster than the average for all occupations through the mid-1980's due to an increase in construction activity. Besides the workers hired to fill openings arising from this increased demand, many will be hired to replace those who retire, die, or take jobs in other occupations. Because construction activity fluctuates, however, the number of new workers needed may vary greatly from year to year.

Most job openings will be in metropolitan areas. Building contractors in small cities may not have enough business to hire full-time drywall workers.

Earnings and Working Conditions

According to limited information, drywall installers and finishers earned from $6.50 to $9 an hour in 1976. By comparison, all nonsupervisory and production workers in private industry, except farming, averaged $4.87 an hour.

Many contractors pay installers and finishers according to the amount of work they complete—for example, from 3 to 5 cents for each square foot of panel installed. In a day, the average drywall worker installs 35 to 40 panels, each 4 feet by 12 feet.

A 40-hour week is standard for installers and finishers, but they sometimes work longer. Those who are paid hourly rates receive premium pay for overtime. Unlike many construction workers, installers and finishers work indoors and do not lose time and pay when the weather is bad.

As in other construction trades, drywall work sometimes is strenuous. Installers and finishers spend most of the day on their feet, either standing, bending, stooping, or squatting. Installers have to lift and maneuver heavy panels. Hazards include the possibility of falls from ladders and injuries from power tools.

Some installers are members of the United Brotherhood of Carpenters and Joiners of America, and some finishers are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For details about job qualifications and training programs, write to:

International Association of Wall and Ceiling Contractors/Gypsum Drywall Contractors International, 1711 Connecticut Ave. NW., Washington, D.C. 20009.

National Joint Painting, Decorating, and Drywall Apprenticeship and Training Committee, 1709 New York Ave. NW., Washington, D.C. 2006.

ELECTRICIANS (CONSTRUCTION)

(D.O.T. 821.381, 824.281, and 829.281 and .381)

Nature of the Work

Heating, lighting, power, air-conditioning, and refrigeration components all operate through electrical systems that are assembled, installed, and wired by construction electricians. These workers also install electrical machinery, electronic equipment and controls, and signal and communications systems. (Maintenance electricians, who usually maintain the electrical systems installed by construction electricians, are discussed elsewhere in the *Handbook*.)

Construction electricians follow blueprints and specifications for most installations. To install wiring in factories and offices, they may bend, fit, and fasten conduit (pipe or tubing) inside partitions, walls, or other concealed areas. Workers also fasten to the wall small metal boxes that will house electrical devices such as switches.

To complete circuits between outlets and switches, they then pull insulated wires or cables through the conduit. They work carefully to avoid damaging any wires or cables. In lighter construction, such as housing, plastic-covered wire usually is used rather than conduit. In any case, electricians connect the wiring to circuit breakers, transformers, or other components. Wires are joined by twisting ends together with pliers and covering the ends with special plastic connectors. When additional strength is desired, they may use an electric "soldering gun" to melt metal onto the twisted wires then cover them with durable, electrical tape. When the wiring is finished, they test the circuits for proper connections and grounding.

For safety, electricians follow National Electrical Code specifications and procedures and, in addition, must comply with requirements of State, county, and municipal electrical codes.

Electricians generally furnish their own tools, including screwdrivers, pliers, knives, and hacksaws. Employers furnish heavier tools, such as pipe threaders, conduit benders, and most test meters and power tools.

Places of Employment

Most of the 260,000 construction electricians employed in 1976 worked for electrical contractors. Many others were self-employed contractors. Construction electricians are employed throughout the country, but are concentrated in industrialized and urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4-year apprenticeship program as the best way to learn the electrical trade. Compared to most other construction trades, electricians have a higher percentage of apprentice-trained workers. However, some people learn the trade informally by working for many

A 4-year apprenticeship program is the best way to learn the electrician trade.

years as electricians' helpers. Many helpers gain additional knowledge through trade school or correspondence courses, or through special training in the Armed Forces.

Apprenticeship programs are sponsored through and supervised by local union-management committees. These programs provide 144 hours of classroom instruction each year in addition to comprehensive on-the-job training. In the classroom, apprentices learn blueprint reading, electrical theory, electronics, mathematics, and safety and first-aid practices. On the job, under the supervision of experienced electricians, apprentices must demonstrate mastery of electrical principles. At first, apprentices drill holes, set anchors, and set up conduit. In time and with experience, they measure, bend, and install conduit, as well as install, connect, and test wiring. They also learn to set up and draw diagrams for entire electrical systems.

Beginners who are not apprentices can pick up the trade informally in a variety of ways. For example, some begin working in manufacturing plants piecing together electrical components. Others start in maintenance where they learn about circuit breakers, fuses, switches, and other electrical devices. Later, they change jobs and broaden their knowledge by working as helpers for experienced electricians. While learning to install conduit, connect wires, and test circuits, helpers are also taught good safety practices.

All applicants should be in good health and have at least average physical strength. Good color vision is important because workers frequently must identify electrical wires by color. Also important are agility and dexterity. Applicants for apprentice positions must be at least 18 years old and usually must be a high school or vocational school graduate with 1 year of algebra. Courses in electricity, electronics, mechanical drawing, science, and shop provide a good background.

To obtain a license, which is necessary for employment in some cities, an electrician must pass an examination which requires a thorough knowledge of the craft and of State and local building codes.

Experienced construction electricians can advance to supervisors, superintendents, or contract estimators for contractors on construction jobs. Many electricians start their own contracting businesses. In most large urban areas, a contractor must have an electrical contractor's license.

Employment Outlook

Employment of construction electricians is expected to increase faster than the average for all occupations through the mid-1980's. As population and the economy grow, more electricians will be needed to install electrical fixtures and wiring in new and renovated homes, offices, and other buildings. In addition to jobs created by employment growth, many openings will arise as experienced electricians retire, die, or leave the occupation for other reasons.

While employment in this field is expected to grow over the long run, it may fluctuate from year to year due to ups and downs in construction activity. When construction jobs are not available, however, electricians may be able to transfer to other types of electrical work. For example, they may find jobs as maintenance electricians in factories or as electricians in shipbuilding or aircraft manufacturing.

Earnings and Working Conditions

According to a survey of metropolitan areas, union wage rates for electricians averaged $10.33 an hour in 1976. This was about twice the average wage of nonsupervisory and production workers in private industry, except farming. Because the seasonal nature of construction work affects electricians less than workers in most building trades, their annual earnings also tend to be higher.

Apprentice wage rates start at from 40 to 50 percent of the rate paid to experienced electricians and increase periodically.

Construction electricians are not required to have great physical strength, but they frequently must stand for long periods and work in cramped quarters. Because much of their work is indoors, electricians are less exposed to unfavorable weather than are most other construction workers. They risk electrical shock, falls from ladders and scaffolds, and blows from falling objects. However, safety practices have helped to reduce the injury rate.

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers.

Sources of Additional Information

For details about electrician apprenticeships or other work opportunities in this trade, contact local electrical contractors; a local chapter of the National Electrical Contractors Association; a local union of the International Brotherhood of Electrical Workers; a local union-management apprenticeship committee; or the nearest office of the State employment service or State apprenticeship agency. Some local employment service offices screen applicants and give aptitude tests.

For general information about the work of electricians, contact:

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

National Electrical Contractors Association, 7315 Wisconsin Ave. NW., Washington, D.C. 20014.

National Joint Apprenticeship and Training Committee for the Electrical Industry, 9700 E. George Palmer Hwy., Lanham, Md. 20801.

ELEVATOR CONSTRUCTORS

(D.O.T. 825.381 and 829.281)

Nature of the Work

Elevator constructors, also called elevator mechanics, assemble and install elevators, escalators, and similar equipment. In new buildings, they install equipment during construction. In older buildings, they replace earlier installations with new equipment. Once the equipment is in service, they maintain and repair it. Installation or repair work usually is performed by small crews consisting of skilled elevator constructors and their helpers.

When installing a new elevator, mechanics first prepare the elevator shaft—a vertical opening that passes through the floors of a building and allows the elevator to move up and down. They remove any obstructions such as wood or metal crossmembers and, at the bottom of the shaft, they may erect forms, then mix and pour concrete for a foundation.

So the elevator will move up and down safely and smoothly, workers erect a strong steel frame within the shaft. For the frame, they bolt heavy steel guide rails to the walls along the shaft as well as to the steel supports fastened to the walls around the shaft at each floor.

To install electrical wires and controls, mechanics secure special metal tubing to the shaft's walls, running it from floor to floor. Workers then pull plastic-covered electrical wires through the tubing, which helps protect the wires. Next, they install circuit breakers and switches—usually at each floor and at the main control panel. Finally workers fasten the wires to the switches and test for proper connections.

Next, mechanics assemble the elevator car at the bottom of each shaft. "Footings" of the car frame are set into the grooves of the heavy steel guide rails; the frame parts are bolted or welded together. Workers then install the car's platform, walls, ceiling, and doors.

For each elevator, workers install a hoist. This giant, electrically powered spool simultaneously winds and unwinds a heavy steel cable that connects the elevator car at one end to its counterweight at the other. As a result, the car and its counterweight move in opposite directions to assist in each other's movement. While the hoist winds the cable from one side, pulling the car upward, it also unwinds the cable on the other side, causing the counterweight to descend. As the weight descends, it helps to pull the car swiftly and smoothly upward.

With the car assembled and the hoist installed, workers connect the necessary electrical wires to the car. These will carry signal instructions for the car's operation.

Next, at the elevator entrances on each floor, mechanics bolt metal door frames to the concrete, metal, or wood ceilings, floors, and walls. The frames support the grooved metal tracks along which the doors open and close. After setting the doors in the frames, workers connect and test the wires that help to operate the doors.

Finally, after the connections have been tested, the cables secured, and the guide rails greased, the entire system is checked for proper operation.

Elevator constructors employ similar work techniques when constructing escalators. These electrically powered stairs rotate around huge oval tracks that run from floor to floor. Unlike elevators, which run according to specific signals, escalators run continuously. Consequently, while elevators need sophisticated circuits and many wires, escalators only need one electric wire. Workers simply connect the wire from a switch to the motor that drives the giant bicycle-like chain and rotates the stairs.

Alteration work is similar to new installation because all elevator equipment except the old rail, car frame, platform, and counterweight is generally replaced. Elevator mechanics inspect elevator and escalator installations periodically and, when necessary, adjust cables and lubricate or replace parts.

Alteration work on elevators is important because of the rapid rate of innovation and improvement in elevator engineering.

To install and repair modern elevators, most of which are electrically controlled, elevator constructors must have a working knowledge of electricity, electronics, and hydraulics. They also must be able to repair electric motors as well as control and signal systems. Because of the variety of their work, they use many different handtools, power tools, and testing meters and gauges.

Growth in the number of high-rise buildings will increase demand for elevator constructors.

Places of Employment

Most of the estimated 20,000 elevator constructors in 1976 were employed by elevator manufacturers to do installation, modernization, and repair work. Some are employed instead by small, local contractors who specialize in elevator maintenance and repair. Still others work for government agencies or business establishments that do their own elevator maintenance and repair.

Training, Other Qualifications, and Advancement

Almost all elevator constructors learn their skills through on-the-job training supplemented by classroom instruction. On the job, trainees are assigned initially to experienced elevator mechanics. Beginning tasks include carrying materials and tools, bolting rails to walls, and assembling cab parts. Eventually, tasks become more complex and require greater knowledge and skill. For example, electrical wiring requires a knowledge of local and national electrical codes and of electrical theory. Later on, trainees learn to test elevators and adjust them for maximum performance. In the classroom, trainees learn electrical and electronic theory, mathematics, applications of physics, and safety techniques.

Generally, training advancement depends upon the trainee's ability and level of experience. The average trainee usually qualifies as a helper after 6 months of experience and usually becomes a fully qualified elevator constructor within 4 years. Some States and cities require elevator constructors to pass a licensing examination.

Applicants for trainee positions must be at least 18 years old and have a high school or vocational school education; courses in electricity, mathematics, and physics can provide a useful background. Applicants also must pass an aptitude test before training begins. Good physical condition and a high degree of mechanical aptitude are important.

Some constructors advance to jobs as supervisors or elevator inspectors. A relatively small number go into the elevator contracting business.

Employment Outlook

Employment in this small occupation is expected to increase faster than the average for all occupations through the mid-1980's. Growth in the number of high-rise apartment and commercial buildings will create job openings in elevator construction, as will the need to replace experienced workers who retire, die, or stop working for other reasons. The total number of job openings will be limited, however, because of the relatively small size of the occupation.

Earnings and Working Conditions

In 1976, union elevator constructors in metropolitan areas had estimated average wages of $10.30 an hour or twice the average wage paid to production and nonsupervisory workers in private industry, except farming. Hourly wage rates for train-

ees start at about 50 percent of the rate paid to experienced elevator mechanics and increase periodically.

Unlike most other construction trades, elevator contructors usually work year round. When construction of new buildings declines, the construction of new elevators and escalators declines, but the demand for the repair and maintenance of older elevators and escalators increases.

Elevator construction involves lifting and carrying heavy equipment and parts, but this is usually done by helpers. Most of the work takes place indoors and at great heights. Workers are exposed to the dangers of falls and electrical shocks.

Most elevator constructors are members of the International Union of Elevator Constructors.

Sources of Additional Information

For further details about work opportunities as a helper in this trade, contact elevator manufacturers, elevator construction or maintenance firms, or a local of the union mentioned above. In addition, the local office of the State employment service may have information about opportunities in this trade.

For general information about the work of elevator constructors, contact:

International Union of Elevator Constructors, 5565 Sterrett Place, Clark Bldg., Suite 332, Columbia, Md. 21044.

FLOOR COVERING INSTALLERS

(D.O.T. 299.381 and 864.781)

Nature of the Work

Floor covering installers (also called *floor covering mechanics*) install and replace carpet or resilient floor covering materials such as tile, linoleum, and vinyl sheets. These workers install coverings over floors made of wood, concrete, or other materials. They generally specialize in either carpet or resilient floor covering installation, although some do both types.

Before putting down resilient covering, such as vinyl tile, installers first inspect the floor to be sure that it is firm, dry, smooth, and free of dust or dirt. Some floors have to be prepared for covering. For example, installers may sand a rough or painted floor and fill cracks and indentations. An extremely uneven floor may be resurfaced with wood or other materials.

On newly poured concrete floors or floors laid over earthwork, installers test for moisture content. If the moisture is too great, they may suggest postponing installation of floor covering or recommend a covering technique suited to the floor's condition.

Resilient-flooring installers measure and mark off the floor according to a plan. The plan may be architectural drawings that specify every detail of the covering design, or a simple, verbal description by the customer. When the plan is completed, installers, often assisted by apprentices or helpers, cut, fit, and glue the flooring into place. It must be carefully fit, particularly at door openings, along irregular wall surfaces, and around fixtures, such as columns or pipes. Installers must take special care also in cutting out and setting in decorative designs. After the flooring is in place, they may run a roller over it to insure good adhesion.

Carpet installers, like the installers of resilient coverings, first inspect the floor to determine its condition. Then they plan the layout after allowing for expected traffic patterns so that best appearance and long wear will be obtained.

For wall-to-wall carpet, installers lay underlayment—a 1/2 to 1 inch thick, foam rubber pad—that is cut slightly smaller than the entire floor. Next, they roll out, measure, mark, and cut the carpet, allowing for 3 to 4 inches of extra carpet on each side. This provides some leeway for mistakes. Workers then lay the carpet and stretch it to fit evenly against the floor and snugly against each wall and door threshold. With the carpet stretched, the excess around the perimeter is cut to fit the room precisely. To hold the carpet in place, workers either tack or tape each edge of the carpet to the floor.

For precut and seamed carpet, installers simply lay a foam rubber pad on the floor and roll the carpet over the slightly smaller pad. To hold the pad and carpet in place, installers may apply tape that has adhesive on both sides to the bottom edges of the carpet.

Places of Employment

An estimated 85,000 floor covering installers were employed in 1976. About four-fifths worked primarily with carpet, and the remainder with resilient flooring.

Most installers worked for flooring contractors. Many others worked for retailers of floor covering and home alteration and repair contractors. About 1 out of 4 floor covering installers was self-employed, a higher proportion than the average for all building trades.

Installers are employed throughout the Nation, but most are concentrated in urban areas that have high levels of construction activity.

Training, Other Qualifications, and Advancement

The vast majority of floor covering installers learn their trades informally on the job by working as helpers to experienced installers. Most others learn through formal apprenticeship programs, which include on-the-job training as well as related classroom instruction.

Informal training programs usually are sponsored by individual contractors and generally take about 1 1/2 years. Helpers begin with simple assignments. Helpers on resilient flooring jobs carry materials and tools, prepare floors for the tile, and help with its installation. Carpet helpers install tackless stripping and padding, and help stretch newly installed carpet. With experience, helpers in either trade take on more difficult assignments, such as measuring, cutting, and fitting the materials to be installed.

Some contractor-sponsored programs and apprenticeship programs provide comprehensive training that covers both carpet and resilient flooring work.

Applicants for helper or apprentice jobs should be at least 16 years

Floor covering installer laying resilient tile.

old, mechanically inclined, and licensed to drive. A high school education is preferred, though not necessary. Courses in general mathematics and shop may provide a helpful background.

Floor covering installers may advance to supervisors or installation managers for large floor laying firms. Some installers become salespersons or estimators. Installers also may go into business for themselves.

Employment Outlook

Employment of floor covering installers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to job openings resulting from employment growth, many openings will arise as experienced installers retire, die, or leave the occupation for other reasons.

Employment of floor covering installers is expected to increase mainly because of the expected expansion in construction and the more widespread use of resilient floor coverings and carpeting. In many new buildings, plywood will continue to replace hardwood floors, thus making wall-to-wall carpet or resilient floors a necessity. Carpet and resilient flooring also will continue to be used extensively in renovation work. Moreover, versatile materials and colorful patterns will contribute to the growing demand for floor coverings.

Most job opportunities will be for carpet installers and workers who can install both carpet and resilient flooring. Fewer opportunities will arise for workers who can install only resilient flooring because this is a relatively small field.

Earnings and Working Conditions

Information from a limited number of firms indicates that experienced floor covering installers earned between $6.25 and $9 per hour in 1976. Starting wage rates for apprentices and other trainees usually are about half of the experienced worker's rate.

Most installers are paid by the hour. In some shops, part of the pay may be in bonuses. In others, installers receive a monthly salary or are paid according to the amount of work they do.

Installers generally work regular daytime hours. Particular circumstances, however, such as installing a floor in a store or office, may require work during evenings or weekends.

Unlike many construction workers, floor covering installers usually do not lose time due to weather conditions. During the winter, most work is done in heated buildings. The jobs are not hazardous, but installers may get injuries from lifting heavy materials or from working in a kneeling position for long periods. Most injuries can be avoided if proper work procedures are followed.

Many floor covering installers belong to unions, including the United Brotherhood of Carpenters and Joiners of America, and the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For details about apprenticeships or work opportunities, contact local flooring contractors or retailers; locals of the unions previously mentioned; or the nearest office of the State apprenticeship agency or the State employment service.

For general information about the work of floor covering installers, contact:

Carpet and Rug Institute, P.O. Box 2048, Dalton, Ga. 30720.

Resilient Floor Covering Institute, 1030 15th St. NW., Suite 350, Washington, D.C. 20005.

GLAZIERS

(D.O.T. 865.781)

Nature of the Work

Construction glaziers cut and install all types of building glass. For

some jobs, the glass is precut and ready to install. For other jobs, glass must be cut before being installed.

To prepare the glass for cutting, glaziers measure and mark the glass to fit the window opening, then rest the glass either on edge or flat against a carpeted table. To help the cutting tool move smoothly across the glass, workers sometimes brush on a thin layer of oil along the line of the intended cut.

Glaziers cut glass with a special tool that has a very hard metal wheel about 1/6 inch in diameter. Using a "straightedge" as a guide, the glazier presses the cutter's wheel firmly to the glass, guiding and rolling it carefully over the surface. This creates a cut on and just below the surface. Immediately after cutting, the glazier presses on the small end, thereby causing the glass to break cleanly along the cut.

The popularity of glass in building design will stimulate the demand for glaziers.

Glaziers may need the help of a crane when installing a large, heavy piece of glass. In all cases, however, since there is a risk of shattering the glass, glaziers use their hands to guide the glass carefully to the opening and to position the glass precisely in its frame.

Glaziers secure glass in an opening with materials such as putty, rubber gaskets, metal clips, and metal or wood molding. When using putty, which is similar to very soft taffy, workers first spread it neatly against and around the edges of the molding on the inside of the opening. Next, they install the glass. With it pressed against the putty on the inside molding, workers then screw or nail outside molding that loosely holds the glass in place. To hold it firmly, they pack the space between the molding and the glass with putty, then trim any excess putty with a putty knife.

Glaziers sometimes use a rubber gasket—a very heavy molded rubber hose with a split running its length—to secure glass. They first glue the gasket around the perimeter within the opening, then set the glass into the split side of the gasket, causing it to clamp to the edges of the glass and hold it firmly in place.

When metal clips and molding are used to secure glass, glaziers first secure the molding, then force springlike metal clips between the glass and the molding. The clips exert pressure on the molding and the glass, thereby keeping it firmly in place.

Glaziers also install glass doors, mirrors, and steel sash.

In addition to handtools such as glasscutters and putty knives, glaziers use power tools, such as cutters and grinders.

Places of Employment

About 10,000 persons worked as construction glaziers in 1976. Most worked for glazing contractors engaged in new construction, alteration, and repair. Others worked for government agencies or businesses that do their own construction work.

Glaziers work throughout the country, but jobs are concentrated in metropolitan areas. Glaziers occasionally may travel to work for a day

or two in small outlying towns where few people, if any, are equipped and qualified to install glass in commercial buildings such as stores.

Training, Other Qualifications, and Advancement

The majority of construction glaziers learn the trade through a 4-year apprenticeship program. Others learn the trade informally, on the job, by assisting experienced workers.

Apprenticeship programs, usually sponsored by local union-management committees, consist of on-the-job training as well as 144 hours of classroom instruction each year. Some apprenticeship programs also require a comprehensive home study course.

On the job, apprentices learn to use the tools and equipment of the trade; handle, measure, cut, and install glass; cut and fit moldings; and install and balance glass doors. In the classroom, they are taught mathematics, blueprint reading, general construction techniques, safety practices, and first-aid.

Those who learn this trade informally usually start by carrying glass and cleaning up debris in large glass shops. They often have the opportunity to practice their cutting techniques on discarded glass. After a year or so, they may have an opportunity to cut glass for a job. Eventually, helpers assist experienced workers on a simple installation job. Learning the trade this way may take considerably longer than through apprenticeship.

Applicants for apprenticeships or helper positions should be in good physical condition and licensed to drive. Persons applying for helper positions will find that employers prefer high school or vocational school graduates. Applicants for apprenticeships must be at least 18 years old and have a high school diploma or its equivalent. Courses in general mathematics, blueprint reading or mechanical drawing, general construction, and shop provide a helpful background.

Glaziers who have leadership ability may advance to supervisory jobs. Some glaziers become contractors.

Employment Outlook

Employment of construction glaziers is expected to increase faster than the average for all occupations through the mid-1980's. Besides the jobs resulting from employment growth, many openings will arise as experienced glaziers retire, die, or leave the occupation for other reasons. The number of openings may fluctuate from year to year, however, because employment in this trade is sensitive to changes in construction activity.

Over the long run, population and business growth will create a rising demand for new residential and commercial buildings, such as apartments, offices, and stores. Since glass will continue to be popular in building design, the demand for glaziers to install and replace glass also will grow.

Employment opportunities should be greatest in metropolitan areas, where most glazing contractors are located.

Earnings and Working Conditions

In 1976, union construction glaziers in metropolitan areas had estimated average wages of $9.25 an hour, or about twice the average hourly wage for production or nonsupervisory workers in private industries, except farming. Apprentice wage rates usually start at 50 percent of the rate paid to experienced glaziers and increase periodically. Yearly earnings of glaziers and apprentices, however, generally are slightly lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Glaziers may be injured by glass edges or cutting tools, falls from scaffolds, or from lifting glass. To reduce injuries, employers and unions emphasize safety training.

Many glaziers employed in construction are members of the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For more information about glazier apprenticeships or work opportunities, contact local glazing or general contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship agency; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of glaziers, contact:

International Brotherhood of Painters and Allied Trades, 1750 New York Ave. NW., Washington, D.C. 20006.

INSULATION WORKERS

(D.O.T. 863.381, .781, and .884)

Nature of the Work

Properly insulated homes and buildings reduce fuel costs by preventing excessive loss of cool air on warm days and hot air on cold days. Meat storage rooms, steam pipes, and boilers are other examples where the wasteful transfer of heat to or from the space inside can be minimized by insulation. Selecting the proper material and method of installation is the responsibility of insulation workers.

Insulation workers—sometimes called applicators—may paste, wire, tape, or spray insulation to an appropriate surface. When covering a steam pipe, for example, insulation workers may cut a tube of insulation to the necessary length, stretch it open along a cut which runs the length of the tube, and then slip it over the pipe. To secure the insulation they wrap and fasten wire bands around it, tape it, or wrap a cover of tar paper, cloth, or canvas over it and then sew or staple the cover in place. Care is required to cover joints completely.

When covering a wall or other flat surface, workers may use a hose to spray foam insulation onto a wire mesh. The wire mesh provides a rough surface to which the foam can cling and adds strength to the fin-

ished wall. If desired, workers apply a final coat for a finished appearance.

In some places, such as attics which do not require either wire mesh for adhesion or a final coat for appearance, applicators use a compressor to "blow-in" the insulation. "Blowing-in" insulation is a simple task. The worker fills the machine with shredded fiberglass insulation, allows the compressor to force the insulation through a hose, and controls the direction and flow of the insulation until the required amount is installed.

Insulation workers use common handtools—trowels, brushes, scissors, sewing equipment, and stapling guns. Powersaws, as well as handtools, are used to cut and fit insulating materials.

Compressors for "blowing-in" or for "spraying-on" insulation also may be used. In using these tools, applicators may have to bend or squat while working on ladders or on scaffolds in dimly lit and sometimes very dusty areas.

Places of Employment

About 30,000 insulation workers were employed in 1976. Most worked for insulation contractors. Others were employed to alter and maintain insulated pipework in chemical factories, petroleum refineries, power plants, and similar structures which have extensive steam installations for power, heating, and cooling. Some large firms which have cold-storage facilities also employ these workers for maintenance and repair.

Training, Other Qualifications, and Advancement

Almost all insulation workers learn their trade through either informal on-the-job training or a formal 4-year "improvership" program; both of these programs stress conservation and safety. A trainee in an informal on-the-job program, usually provided by and paid for by an insulation contractor, is assigned to an experienced insulation worker for instruction and supervision. A trainee begins with simple tasks, such as "blowing-in" insulation, supplying insulation material to experienced workers, or holding the material while they fasten it in place. In about 6 to 8 months, assignments become more complex, and within a year a trainee usually learns to measure, cut, fit, and install various types of insulation. With experience, the trainee receives less supervision, more responsibility, and higher pay.

Trainees who receive informal instruction usually learn to specialize in only three or four types of installation. In contrast, trainees in 4-year "improvership" programs—much like the apprenticeship programs of other trades—receive in-depth instruction in almost all phases of insulation work. The in-depth instruction is provided by and paid for by a joint committee of local insulation contractors and the local union of insulation applicators. The committee determines the need for "improverships," screens and tests applicants, and ensures the availability of proper training programs. Programs consist of on-the-job training as well as classroom instruction, and trainees must pass practical and written tests to demonstrate a knowledge of the trade.

For entry jobs, insulation contractors prefer high school graduates who are in good physical condition and licensed to drive. High school courses in blueprint reading, shop math, and general construction provide a helpful background.

Applicants seeking 4-year "improvership" positions must have a high school diploma or its equivalent, and be at least 18 years old. Application can be made through local contractors, unions, or a joint committee.

Skilled insulation workers may advance to supervisor, shop superintendent, or insulation contract estimator, or may open an insulation contracting business.

Employment Outlook

Employment of insulation workers is expected to grow much faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, several hundred openings will arise annually from the need to replace workers who transfer to other occupations, retire, or die.

More workers will be needed to install energy-saving insulation in homes and businesses.

More workers will be needed to install energy-saving insulation in new homes and businesses. Insulation for boilers and pipes in new factories and power plants also will stimulate employment growth. Moreover, old buildings that need extra insulation to save fuel will add to employment requirements.

Employment opportunities will be best in metropolitan areas, where most insulation contractors are located. In small towns much of the insulation work is done by persons in other trades, such as heating and air-conditioning installers, carpenters, and drywall installers, rather than by insulation workers.

Earnings and Working Conditions

Union insulation workers in metropolitan areas had estimated average wages of $9.75 an hour in 1976, slightly higher than the average for all union building trades workers. Apprentice wage rates start about half the rate paid to experienced workers and increase periodically.

According to limited information, experienced nonunion insulation workers earn from $200 to $300 per week. Nonunion trainees earn from $120 to $140 per week.

Insulation workers spend most of the workday on their feet, either standing, bending, stooping, or

squatting. Sometimes they work from ladders or in tight spaces. Removing old insulation before installing new materials is often dusty and dirty. Tearing out asbestos—at one time the most common form of insulation but rarely used today—can be very dangerous to the workers' health unless they follow proper safeguards.

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers.

Sources of Additional Information

For information about insulation workers' improvership programs or other work opportunities in this trade, contact a local insulation contractor; a local of the union mentioned above; or the nearest office of the State employment service or State apprenticeship agency.

IRONWORKERS

(D.O.T. 801.281, .381, .781, .884; 809.381, .781, .884; and 869.883)

Nature of the Work

Ironworkers erect steel framework and other metal parts in buildings, bridges, and other structures. They also rig heavy construction machinery (prepare it for moving) and deliver the machinery to new sites. In addition, ironworkers make alterations, such as installing steel stairs or adding window guards to buildings, and do repair work, such as replacing metal bridge parts.

Ironworkers comprise four related trades—structural ironworkers, riggers and machine movers, ornamental ironworkers, and reinforcing ironworkers. Many ironworkers are skilled in two of these trades or more.

Structural ironworkers (D.O.T. 809.381) erect, align, and fasten the steel framework of bridges, buildings, and other structures such as storage tanks. They also install floor decking and the doors and frames of bank vaults. Ironworkers follow blueprint specifications in erecting steel framework. They direct crane operators to hoist each steel part into proper position. Workers often push, pull, or pry beams and girders for last-second positioning before temporarily bolting them in place.

To permanently connect a steel member, ironworkers measure for correct alignment, using plumb bobs, levels, and measuring tapes. They remove temporary bolts if necessary, then jockey the steel beam or girder into position, using winches, hoists, and jacks. When the member is correctly aligned, workers bolt, rivet, or weld it to others for final fastening.

Riggers and machine movers (D.O.T. 869.883) set up and rig the hoisting equipment used to erect and dismantle structural steel frames. These skilled workers also move heavy construction machinery and equipment. They study the size, shape, and weight of the object to be moved, choose lines and cables to support its weight, and select points of attachment that will provide a safe and secure hold on the load. Next, they hook or bolt one or more cables to both the hoisting equipment and the item to be moved. Workers then direct the load into position by giving hand signals and other directions to the hoisting machine operator. In many instances, riggers build platforms or containers on the job to move unusually shaped materials and machines. This work requires a knowledge of hoisting equipment and lifting devices.

Ironworkers often work at great heights.

Ornamental ironworkers (D.O.T. 809.381) install metal stairways, catwalks, floor gratings, ladders, and window frames. They also install lampposts, fences, and decorative ironwork. In addition, they work with prefabricated aluminum, brass, and bronze items. Examples are recently developed ornamental building facades that are bolted or welded to a building.

Since other workers cut and shape most of the ornamental metal away from the construction site, ornamental ironworkers spend most of their time fitting, aligning, and assembling. On the job, workers make sure ornamental pieces fit correctly and hold firmly. Workers hacksaw oversized pieces to size and sometimes must drill holes. For secure connections, they rivet or weld the metals.

Reinforcing ironworkers (D.O.T. 801.884) set steel rods or bars in concrete forms to reinforce the concrete. They place the steel bars on suitable supports in the concrete form, then tie the bars together by wrapping and twisting wire around them. Workers follow supervisory instructions or blueprint specifications to make sure the reinforcing rods are positioned properly. Some concrete is reinforced with a coarse mesh made of welded wire. When using mesh, ironworkers measure the surface to be covered, cut and bend the mesh to the desired shape, and place it over the area to be reinforced. While a concrete crew pours the slab, ironworkers use hooked rods to position the wire mesh in the freshly poured mixture.

Places of Employment

About 71,000 structural and ornamental ironworkers were employed in 1976. Thousands of additional workers were employed as riggers, machine movers, and reinforcing ironworkers.

Most of these workers are employed by general contractors on large building projects, steel erection contractors, or ornamental iron contractors. Many are employed by large

steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial firms that do their own construction work. Very few are self-employed.

Ironworkers work in all parts of the country, but they are concentrated in metropolitan areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of an apprenticeship as the best way to learn these trades. Some people, however, learn these trades informally by working as helpers to experienced ironworkers.

Apprenticeship programs, many of which are sponsored by local union-contractor agreements, usually consist of 3 years of on-the-job training and a minimum of 144 hours a year of classroom instruction in subjects such as drafting, blueprint reading, and mathematics applicable to layout work. Apprentices learn ornamental assembling, reinforcing, rigging, structural erecting, and welding.

Those who learn the trade informally usually start by moving materials—hauling rods and disposing of debris. Within a short period they can set reinforcing rods. Eventually, they do ornamental or structural work.

Applicants for apprenticeship or helper positions generally must be at least 18 years old and have a high school or vocational school education; courses in general mathematics and mechanical drawing provide a helpful background.

Since materials used in ironworking trades are heavy and bulky, above-average physical strength is necessary. Agility and a good sense of balance also are required in order to work at great heights and on narrow footings.

Experienced ironworkers can advance to supervisory positions. A small number go into the ironworking business.

Employment Outlook

Employment of ironworkers is expected to increase much faster than the average for all occupations through the mid-1980's. Growth in construction activity will increase the demand for these workers. Besides jobs resulting from employment growth, many openings will result from the need to replace experienced ironworkers who transfer to other fields of work, retire, or die. The number of job openings may fluctuate from year to year, however, because construction activity is sensitive to changes in the economy.

Employment in all ironworking occupations is expected to increase over the long run. The growing use of structural steel in buildings will create a need for more structural ironworkers. Work opportunities for ornamental ironworkers will result from the growing popularity of ornamental panels for large buildings, and of metal frames to hold large glass installations. More riggers and machine movers will be needed to handle the increasing amount of heavy construction machinery. The growing demand for prestressed concrete will create additional job opportunities for reinforcing ironworkers.

Job openings for ironworkers usually are more abundant during the early spring when the weather warms up and the level of construction activity increases.

Earnings and Working Conditions

Union structural and reinforcing ironworkers in metropolitan areas earned estimated average wages of $10 an hour in 1976, or about twice the average wage of nonsupervisory and production workers in private industry, except farming. Apprentices start at 60 percent of the hourly rate paid to experienced workers. They receive increases as they gain experience. Annual earnings for these workers, however, are generally lower than hourly wages would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Ironworkers often work at great heights, sometimes walking on mere I foot wide girders 20 floors or more above the ground. Although many of these workers risk injury from falls, safety devices such as nets, safety belts, and scaffolding have helped prevent accidents.

Ironwork can involve considerable travel because demand may be insufficient to keep local crews continually employed.

Many workers in these trades are members of the International Association of Bridge, Structural and Ornamental Iron Workers.

Sources of Additional Information

For more information on apprenticeships or other work opportunities, contact local general contractors; a local of the union mentioned above; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about ironworkers, contact:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

LATHERS

(D.O.T. 842.781)

Nature of the Work

What makes cement cling to a ceiling? Lath does. If properly installed, lath creates a firm support to which wet cement, plaster, or stucco will hold fast to form ceilings and walls. The one who installs lath is called a lather.

Until the last century, lath was made exclusively of wood. Since then, metal and gypsum have replaced wood because of their versatility, strength, and fire proofing properties. Metal lath comes in different forms, but it is usually wire mesh. Gypsum lath comes in 1/2 inch thick sheets, ranging from 1 1/4 feet by 4 feet to 4 feet by 8 feet.

Each type of lath holds cement, plaster, or stucco in a particular way. For example, wet plaster penetrates openings in the lath and is held in place mechanically. When applied to gypsum lath, however, chemicals in the wet plaster react with other

Lather wire-ties metal lath.

chemicals on the lath's surface, bonding the materials together.

Lathers use various methods of installation depending on the purpose of the job, the kind of building, and the type of lath specified. On walls and ceilings, lathers usually clip, nail, screw, staple, or wire-tie the lath directly to the building's framework. On cinder block or masonry walls, it is necessary to build a light metal or wood frame, called furring, onto the building's structure. Then they attach the lath to the furring. While installing lath, workers cut openings in it for electrical outlets and water pipes.

Lathers install a special wire mesh reinforcement on inside angles and corners or walls to prevent cracking. On outside or exposed corners, they attach a corner support that provides protection and strength.

Sometimes lathers install two layers of lath. For example, when stucco (a mixture of portland cement and sand) is to be applied over a wood framework, workers may install two layers of wire mesh, separated by a layer of felt, to serve as a base for the stucco.

In ornamental work or curved surface work, workers build a frame approximating the desired shape, and then attach the lath to the frame.

Lathers also install suspended ceilings. They wire-tie metal bands to rods or wires attached to the structure above. Installers run the metal bands horizontally across the room, crisscrossing them to form rectangular spaces. These spaces can serve to hold either ceiling panels or lath to which plaster is applied.

To do their work, lathers use drills, hammers, hacksaws, shears, wirecutters, hatchets, stapling machines, and power-actuated fastening devices.

Places of Employment

Most lathers—who numbered about 20,000 in 1976—work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. A relatively small number of lathers are employed outside the construction industry; for example, some make the lath backing for plaster display materials or scenery.

Training, Other Qualifications, and Advancement

Most training authorities recommend apprenticeship as the best way to learn lathing. However, many lathers, particularly in small communities, have acquired their skills informally by working as helpers, observing or being taught by experienced lathers.

Apprenticeship programs usually last a minimum of 2 years, and are usually sponsored by various local joint labor-management committees. All programs include on-the-job training; some also include classroom instruction. On the job, under the guidance of an experienced worker, apprentices learn to use the tools and materials of the trade. Initially, they work on simple tasks, such as nailing gypsum lath to wall partitions. After gaining experience, they advance to more complex jobs, such as installing wire mesh on curved surfaces. Classroom instruction includes applied mathematics, blueprint reading, sketching, estimating, basic welding, and safety.

Informal on-the-job training provides only the essential knowledge needed by trainees. They start with easy jobs such as carrying materials or holding lath in place while experienced workers secure it. Trainees soon learn to clip, nail, staple, and wire-tie the lath—first, to walls and later, to floors and ceilings.

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Generally, applicants for apprentice or helper should be at least 16 years old, in good physical condition, and licensed to drive. Apprenticeship applicants are usually required to have a high school or vocational school education, or the equivalent. Courses in general mathematics and mechanical drawing can provide a helpful background. Aptitude tests often are given to determine manual dexterity and mechanical ability.

Some experienced lathers may become supervisors. Others may be able to start their own lath contracting business.

Employment Outlook

Employment of lathers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to growth, additional jobs will result from the need to replace workers who retire, die, or leave the occupation for other reasons. Because the number of lathers is small, however, there will be relatively few job openings annually.

Growth in population and business activity are expected to stimulate the construction of new, and the renovation of old, buildings. As a result, more lathers will be needed to construct some of the more expensive new buildings, to renovate older buildings, and to fill the demand for lath and plaster on curved surfaces where drywall is not a practical substitute.

Earnings and Working Conditions

In 1976, union lathers in metropolitan areas had estimated average wages of $9.80 an hour. This is about twice the average wage of nonsupervisory and production workers in private industry, except farming. Apprentices start at about 50 percent of the wage rate paid to experienced lathers and receive more as they gain experience. However, yearly earnings for lathers and apprentices generally are lower than hourly rates would indicate because the annual number of hours that they work can be adversely affected by poor weather and fluctuations in construction activity.

Although lathers' work is not strenuous, it does require standing, squatting, or working overhead for long periods. Workers can be injured by falls from scaffolds or by cuts from various working materials or tools.

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union.

Sources of Additional Information

For information about lathers' apprenticeships or other work opportunities in the trade, contact a local lathing or plastering contractor; a local of the Wood, Wire and Metal Lathers International Union; a local joint labor-management apprenticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about the work of lathers, contact:

International Association of Wall and Ceiling Contractors, Gypsum Drywall Contractors International, 1711 Connecticut Ave. NW., Washington, D.C. 20009.

National Lathing Industries Joint Apprenticeship Program, 815 16th St. NW., Washington, D.C. 20006.

OPERATING ENGINEERS (CONSTRUCTION MACHINERY OPERATORS)

(D.O.T. 850.782 through .883, 851.782 and .883, 852.883, 853.782 and .883, and 859.782 and .883)

Nature of the Work

Lifting a quarter-ton pane of glass by crane and positioning it into an 8-foot by 10-foot window opening 10 stories above the ground requires considerable skill. At the crane's controls is an operating engineer. Operating engineers also work the controls of bulldozers, trench excavators, paving machines, and many other types of construction machinery. Some workers know how to operate several kinds of machines; others, only a few. Because the skills and training required vary, operating engineers usually are classified by either the type or the capacity of machines they operate.

Heavy machines are usually complex and difficult to operate. A large crane, for example, requires a high degree of skill. Operators must accurately judge distances and heights and push or pull a number of buttons, levers, and pedals in proper sequence while picking up and delivering materials. These controls rotate the crane, raise and lower its boom and loadline, or open and close attachments such as steel-toothed buckets for lifting dirt or clamps for lifting materials. At times, operators may not see either the pickup or delivery point and must follow the hand or flag signals of another worker.

Medium-sized equipment, on the other hand, usually requires less skill to operate. Bulldozer operators, for example, generally handle fewer controls than crane operators, and since the "dozer" operator works at ground level, estimating distances is less of a problem.

Operating a bulldozer is somewhat like driving a car and can be a relatively simple task. The huge "blade" attached to the front can be raised or lowered by pushing a button or by pushing or pulling a lever. To clear land, a bulldozer operator simply lowers the blade to the ground, shifts to forward gear and presses a pedal for power, causing the blade to scrape and level the ground. The operator will back up and repeat the process until the land is cleared.

Of the three weight classifications, light equipment such as an air compressor is the easiest to operate and, therefore, requires the least skill.

Before starting an air compressor (a diesel engine that takes in air and forces it through a narrow hose), the operator checks for tight hose connections and may manually pump air through the compressor to check for leaks. The operator also makes sure the compressor has fuel and water. The operator then starts the air compressor and allows it to build sufficient pressure to run special "air" tools. While the compressor is running, the operator periodically checks fuel, water, and pressure levels. At the end of the work day, the operator turns the compressor off and "bleeds-off" pressure in the air

hose by opening an air pressure release valve. This allows for easy engine starting the next time it is to be used.

Operating engineer helpers, sometimes called "oilers," make sure the machines have gas and oil and are properly lubricated. Helpers also make minor repairs and adjustments. Experienced operators who are working alone also perform these tasks. Major repairs, however, usually are made by heavy-equipment mechanics.

Places of Employment

Approximately 600,000 operating engineers were employed in 1976. An estimated 290,000 operated excavating, grading, and road machinery; about 130,000 worked as bulldozer operators; and nearly 165,000 operated other construction machinery, including cranes, derricks, hoists, air compressors, trench-pipe layers, and dredges.

Most operating engineers work for contractors in highway, dam, airport, and other large-scale construction projects. Others work for utility companies, manufacturers, and other business firms that do their own construction work, as well as State and local highway and public works departments. Some operating engineers are employed in factories and mines to operate cranes, hoists, and other power-driven machinery. Less than one-tenth of all operating engineers are self-employed, a smaller proportion than in most building trades.

Operating engineers are employed in every section of the country, both in large cities and in small towns. Some work on highways and dams being built in remote locations.

Training, Other Qualifications, and Advancement

Although in years past, some operating engineers have learned their skills on the job without formal instruction, employers today prefer individuals with some formal training. Most training authorities recommend completion of a 3-year formal apprenticeship as the best way to become an operating engineer. Since apprentices learn to operate a variety of machines, they have better job opportunities. Less extensive training is available through special heavy-equipment training schools.

Operating engineers must judge distances accurately and handle controls precisely.

The apprenticeship program, usually sponsored through a union-management committee but also available in the Armed Forces, consists of at least 3 years of on-the-job training, as well as 144 hours a year of related classroom instruction.

Under the supervision of experienced operating engineers, apprentices work as oilers or as helpers. Initial tasks include cleaning, greasing, repairing, and starting machines. Within a year, apprentices usually are given the opportunity to perform simple machine operations, such as light lifts with a crane. In time, they receive less supervision and more responsibility. In the classroom, apprentices receive instruction in engine operation and repair, cable splicing, hydraulics, welding, and safety and first aid.

A number of private schools offer instruction in the operation of certain types of construction equipment. Persons considering enrolling in any school, whether public or private, that offers training for an operating engineer career should contact construction employers in their area to determine the school's performance in producing suitably trained condidates.

For apprentice jobs, employers prefer to hire high school or vocational school graduates who are at least 18 years old. Courses in driver education and automobile mechanics provide a helpful background. Experience in operating tractors and other farm machinery also is helpful.

Operating engineers who have leadership ability may become supervisors, but opportunities are few. Some operating engineers start their own excavating and grading business.

Employment Outlook

Job opportunities for operating engineers should be fairly plentiful over the long run. Employment in this occupation is expected to grow faster than the average for all occupations through the mid-1980's. Population and business growth will lead to the construction of more factories, mass transit systems, office buildings, powerplants, and other structures, thereby increasing the demand for operating engineers. More operating engineers also will be needed in other areas, such as maintenance on highways and materials movement in factories and mines.

Besides the job openings created by employment growth, many openings will arise as experienced operating engineers retire, die, or leave the

occupation for other reasons. Jobs should be easiest to find during spring and summer since construction picks up as the weather becomes warmer. However, because construction activity is sensitive to ups and downs in the economy, the number of job openings may fluctuate from year to year.

Earnings and Working Conditions

Wage rates for operating engineers vary according to the machine operated. According to 1976 estimates of union wages in metropolitan areas, hourly rates for crane operators averaged $9.90; for bulldozer operators, $9.55; and for air compressor operators, $8.65. These rates are about twice as much as the average for all nonsupervisory and production workers in private industry, except farming. Annual earnings, however, generally are lower than hourly wage rates would indicate because the annual number of hours worked can be adversely affected by poor weather and fluctuations in construction activity. Hourly wage rates for apprentices start at about 70 percent of the full rate paid to experienced workers and increase periodically.

Operating engineers work outdoors; consequently, they usually work steadily during the warmer months and experience slow periods during the colder months. Time also may be lost due to rain or snow. Operating some machines, particularly bulldozers and some types of scrapers, is physically tiring because the constant movement of the machine shakes or jolts operators and may subject them to high noise levels.

Many operating engineers are members of the International Union of Operating Engineers.

Sources of Additional Information

For further information about apprenticeships or work opportunities in this occupation, contact a local of the International Union of Operating Engineers; a local joint apprenticeship committee; or the nearest office of the State apprenticeship agency. In addition, the local office of the State employment service may provide information about apprenticeship and other programs that provide training opportunities.

For general information about the work of operating engineers, contact:

Associated General Contractors of America, Inc., 1957 E St. NW., Washington, D.C. 20006.

International Union of Operating Engineers 1125 17th St. NW., Washington, D.C. 20036.

PAINTERS AND PAPERHANGERS

(D.O.T. 840.381, .781 and .844, and 841.781)

Nature of the Work

Painting and paperhanging are separate, skilled trades although some people do both types of work. Painters apply paint varnish, and other finishes to decorate and protect building surfaces. Paperhangers cover walls and ceilings of rooms with decorative wallpaper, fabric, vinyl, or similar materials.

Painters sand or scrape away old paint from the surface to be painted so that paint will adhere properly. If the paint is difficult to remove, they loosen it with special materials or equipment before sanding. They also remove grease, fill nail holes and cracks, sandpaper rough spots, and brush off dust. When painting new surfaces, they cover them with a primer or sealer to make a suitable surface for the finish coat.

Painters must be skilled in handling brushes and other painting tools so that they can apply paint thoroughly, uniformly, and rapidly to any type of surface such as wood, concrete, metal, masonry, plastic, or drywall. They must be able to mix paints and match colors, using a knowledge of paint composition and color harmony. They also must know the characteristics of common types of paints and finishes from the standpoints of durability, suitability, and ease of handling and application.

Painters often use rollers or spray guns instead of brushes. Rollers are used on even surfaces such as walls and ceilings. Spray guns are used on surfaces that are difficult to paint with a brush, such as cinder block and metal fencing. Both rollers and spray guns permit faster painting.

Painters also erect scaffolding, including "swing stages" (scaffolds suspended by ropes or cables attached to roof hooks) and "bosun chairs" (a device somewhat like a child's swing), which they use when working on tall buildings and similar structures.

Generally, painters only paint. Paperhangers, however, both paint and hang wallpaper. As a result, paperhangers require more training and additional skills.

The first step in paperhanging is to prepare the surface to be covered. Paperhangers apply "sizing," a material that seals the surface and enables the paper to stick better. In redecorating, they may have to remove old paper by wetting it with water-soaked sponges or—if there are many layers—by steaming. Frequently, it is necessary for paperhangers to patch holes with plaster.

After carefully positioning the patterns to match at the ceiling and baseboard, paperhangers measure the area to be covered and cut a length of wallpaper from the roll. They then apply paste to the strip of paper, place it on the wall, and smooth it by hand or with a brush. They cut and fit edges at the ceiling and base, and smooth seams between strips with a roller or other special tool. They inspect the paper for air bubbles and other imperfections in the work. Air bubbles are removed by smoothing the paper strip toward the outer edges. When working with wall coverings other than paper, such as fabric or vinyl, paperhangers follow the same general procedure.

Places of Employment

About 410,000 painters and 15,000 paperhangers were employed in 1976. Many worked for contractors engaged in new construction, repair, alteration, or modernization work. Hotels, office buildings, shipyards, manufacturing firms, schools,

Painters make up one of the largest building trades.

and other organizations that own or manage extensive property holdings also employed maintenance painters.

A high proportion of workers in these trades are in business for themselves. About one-fourth of the painters and more than half of the paperhangers are self-employed. In comparison, only one-tenth of all building trades workers are self-employed.

Training, Other Qualifications, and Advancement

Opportunities to learn painting and paperhanging range from formal apprenticeship to informal, on-the-job instruction.

Most training authorities recommend the completion of a formal apprenticeship as the best way to become a painter or paperhanger. However, apprenticeship opportunities are very limited, and new workers generally begin as helpers to experienced painters. Very few informal training programs exist for paperhanger trainees because there are very few paperhangers and most work alone. As a result, a larger percentage of paperhangers than painters are trained through apprenticeship.

The apprenticeship for painters and paperhangers generally consists of 3 years of on-the-job training, in addition to 144 hours of related classroom instruction each year. Apprentices receive instruction in subjects such as color harmony; use of tools; surface preparation; cost estimating; paint mixing and matching; and safety. They also learn the relationship between painting and paperhanging and the work performed by the other building trades.

On-the-job instruction, unlike the apprenticeship, has neither a set period of training nor related classroom instruction. Under the direction of experienced painters, trainees carry supplies, erect scaffolds, and do other simple tasks while they learn about the different kinds of paint and painting equipment. Within a short time, trainees learn to prepare metal, wood, and other surfaces for painting; to mix paints; and to paint with a brush, roller, and sprayer. Near the end of their training, they learn decorating concepts, color coordination, and cost-estimating techniques.

Applicants for apprentice or helper jobs generally must be at least 16 years old and in good physical condition. A high school or vocational school education is preferred, although not essential. Courses in chemistry and general shop are useful. Applicants should have manual dexterity and a good color sense. They cannot be allergic to fumes from paint or other materials used in these trades.

Painters and paperhangers may advance to jobs as cost estimators for painting and decorating contractors. Some may become superintendents on large contract painting jobs, or they may establish their own painting and decorating businesses.

Employment Outlook

Employment of painters is expected to grow about as fast as the average for all occupations through the mid-1980's. Replacement needs will create more job openings than growth. Many new workers will be hired to replace experienced painters who retire, die, or leave their jobs for other reasons. The number of job openings, however, may vary greatly from year to year as well as within any given year because the demand for painters is sensitive to fluctuations in construction activity caused by economic and seasonal conditions.

Over the long run, population and business growth will create a rising demand for new houses and buildings and more workers will be needed to paint these structures. Additional workers also will be hired to repaint existing structures.

Employment of paperhangers is expected to increase much faster

than the average for all occupations through the mid-1980's. The demand for these workers should be stimulated by the rising popularity of wallpaper and more durable wall coverings such as vinyl. Since this is a relatively small trade, however, job openings for paperhangers will be far less numerous than those for painters.

Earnings and Working Conditions

Based on a survey of metropolitan areas, union hourly rates for painters and paperhangers averaged about $9.25 in 1976. In comparison, the average rate for experienced union workers in all union building trades was $9.47 an hour while production workers in manufacturing as a whole averaged $4.87 an hour. Annual incomes for some painters, particularly those on outside jobs, may not be as high as hourly rates would indicate because some worktime is lost due to bad weather and occasional unemployment between jobs.

Hourly wage rates for apprentices usually start at 50 percent of the rate paid to experienced workers and increase periodically until the full rate of pay is reached at the completion of apprenticeship.

Painters and paperhangers must stand for long periods. Their jobs also require a considerable amount of climbing and bending. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls off ladders and scaffolds. However, the injury rate for employees of painting, paperhanging, and decorating contractors in the construction industry has been significantly lower than the average for contract construction as a whole.

A large proportion of painters and paperhangers are members of the International Brotherhood of Painters and Allied Trades. A few are members of other unions.

Sources of Additional Information

For details about painting and paperhanging apprenticeships or other work opportunities in these trades, contact local painting and decorating contractors; a local of the International Brotherhood of Painters and Allied Trades; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or State employment service.

For general information about the work of painters and paperhangers, contact:

International Brotherhood of Painters and Allied Trades, 1750 New York Ave. NW., Washington, D.C. 20006.

Painting and Decorating Contractors Association of America, 7223 Lee Hwy., Falls Church, Va. 22046.

National Joint Painting, Decorating, and Drywall Finishing Apprenticeship and Training Committee, 1709 New York Ave. NW., Suite 110, Washington, D.C. 20006.

PLASTERERS

(D.O.T. 842.381 and .781)

Nature of the Work

Plasterers finish interior walls and ceilings with plaster coatings that form fire-resistant and relatively soundproof surfaces; they apply durable cement plasters or stucco to exterior surfaces. Plasterers also cast ornamental designs in plaster.

To interior surfaces such as cinder block or gypsum lath, plasterers apply two coats of plaster. The first or "brown" coat is a heavy, brown mixture; the second or "finish" coat a thin, pasty plaster. However, when the foundation consists of metal lath (a supportive wire mesh), plasterers apply a preparatory coat to the lath.

When applying a preparatory or "scratch" coat, plasterers either spray or use a trowel (a flat, 4 inch by 10 inch, metal plate with a handle) and wavelike motions to spread a thick, gritty plaster into and over the metal lath. Before the plaster on the lath dries, workers scratch its already uneven surface with a rakelike tool, producing ridges so the "brown" coat will cling tightly.

For the first or "brown" coat—whether applied to a scratch coat, cinder block or gypsum lath—workers prepare a thick, but smooth plaster. Workers either spray or trowel this mixture onto the surface, pushing plaster into cracks and holes, and then smoothing the plaster to an even surface for finishing.

For the finish coat, plasterers prepare a thin plaster of very fine granules. They usually hand trowel this mixture very quickly onto the "brown" coat to produce a very thin, very smooth finish for a ceiling or wall.

Plasterers create decorative surfaces as well. For example, while the final coat is still moist, they press firmly against the surface with a brush and use a circular hand motion to create decorative swirls.

For exterior work, plasterers apply a scratch coat to wire lath in the same way that they plaster interior surfaces. To the exterior scratch coat, workers usually apply a gritty mixture of white cement and sand—called stucco—to produce a durable final coat. As an alternative, they plaster an extra heavy mixture over the scratch coat, then embed marble or gravel chips about halfway into the mixture, thus achieving a uniform, pebble like surface.

Plasterers sometimes do complex decorative and ornamental work. For example, they may mold intricate designs for the walls and ceilings of public buildings. To make these designs, plasterers mix a special plaster, pour it into a mold, and allow time for drying. When these are dry,

Plastering requires considerable standing, stooping, and lifting.

workers remove the molded plaster and paste it to the desired surface. Plasterers who do this work must follow blueprints and other specifications furnished by architects.

Plasterers use many special tools. They hold the plaster mixture on a hawk (a light metal plate with a handle) and apply the wet mixture with a trowel. Smoothing and finishing are done with straightedges, beveledges, rods, floats, and other handtools. They also may use spray machines to apply plaster on both base and finish coats.

Places of Employment

Plasterers—who numbered about 24,000 in 1976—worked mostly on new construction and alteration work, particularly where special architectural and lighting effects were part of the job. Some plasterers repaired older buildings.

About 1 out of every 5 plasterers was self-employed.

Training, Other Qualifications, and Advancement

Most training authorities recommend completion of an apprenticeship as the best way to learn plastering. However, many people learn the trade by working as helpers or laborers, observing and being taught by experienced plasterers.

Apprenticeship programs, sponsored by local joint committees of contractors and unions, generally consist of 3 or 4 years of on-the-job training, in addition to at least 144 hours of annual classroom instruction in drafting, blueprint reading, and mathematics for layout work. Training is extensive. In class, apprentices start with a history of the trades and the industry. They also learn about the uses of plaster, costs, and many other concepts. On the job, they learn about lath bases, plaster mixes, methods of plastering, blueprint reading, and safety. Trainees follow the directions of and receive assistance from experienced plasterers.

Those who learn the trade informally as helpers gain only the basics—mixing and applying plasters. They usually start by carrying materials, setting up scaffolds, and mixing plaster. In a short time, they learn—through trial and error—to apply the scratch and brown coats. Learning to apply the finish coat takes considerably longer.

Applicants for apprentice or helper jobs generally must be at least 17 years old, in good physical condition, and have manual dexterity. Applicants who have a high school or vocational school education are preferred. Courses in general mathematics, mechanical drawing, and shop provide a useful background.

Plasterers may advance to supervisor, superintendent, or estimator for plastering contractors, or may become self-employed.

Employment Outlook

Little change is expected in the employment of plasterers through the mid-1980's. Nevertheless, a relatively small number of job openings will result from the need to replace experienced workers who retire, die, or transfer to other occupations.

The use of drywall materials in place of plaster has reduced the demand for plasterers in recent years. Nevertheless, plasterers still are needed for renovating older buildings that have plaster walls. Plaster is also used in some of the more expensive new buildings and on curved surfaces where drywall materials are not practical.

Earnings and Working Conditions

Union wage rates for plasterers in metropolitan areas averaged $9.48 an hour in 1976. This is about twice the average wage of nonsupervisory and production workers in private industry, except farming. Apprentice wage rates start at about half the rate paid to experienced plasterers and increase periodically. However, yearly earnings for plasterers and apprentices are generally lower than hourly rates would indicate because the annual number of hours that they work can be adversely affected by poor weather and fluctuations in construction activity.

Plastering requires considerable standing, stooping, and lifting. Plasterers work outdoors when applying stucco but most jobs are indoors.

A large proportion of plasterers are members of unions. They are represented by either the Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers' International Union of America.

Sources of Additional Information

For information about apprenticeships or other work opportunities, contact local plastering contractors; locals of the unions previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State apprenticeship agency or the State employment service.

For general information about the work of plasterers, contact:

Bricklayers, Masons and Plasterers' International Union of America, 815 15th St. NW., Washington, D.C. 20005.

International Association of Wall and Ceiling Contractors/Gypsum Drywall Contractors International, 1711 Connecticut Ave., NW., Washington, D.C. 20009.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada, 1125 17th St. NW., Washington, D.C. 20036.

PLUMBERS AND PIPEFITTERS

(D.O.T. 862.381)

Nature of the Work

Plumbers and pipefitters install pipe systems that carry water, steam, air, or other liquids or gases. They also alter and repair existing pipe systems and install plumbing fixtures, appliances, and heating and refrigeration units.

Although plumbing and pipefitting are sometimes considered a single trade, workers can specialize in either craft. Plumbers install water, gas, and waste disposal systems in homes, schools, factories, and other buildings. Pipefitters, on the other hand, install both high- and low-pres-

sure pipes that carry hot water, steam, and other liquids and gases for use in industrial processes. For example, pipefitters install the complex pipe systems in oil refineries and chemical processing plants.

In each of these trades, installation techniques are similar because they all involve pipes, faucets, and valves, and problems encountered in one trade are similar to those in another.

Most pipes are copper, cast iron, or some other metal; others may be plastic, glass, or other non-metallic material. While some iron pipes come ready to install, other metal or plastic pipes may have to be "fitted" for the job. To fit pipes, workers may have to measure, bend, cut, and thread pipes, then bolt, braze, glue, screw, solder, or weld them together.

For exacting cuts, workers use a pipecutter. This tool has a long handle and two very sharp, 1- to 2-inch, steel-cutting wheels. Workers separate the wheels' edges, set the pipe between them, then tighten the wheels against the pipe. Tightening causes the sharp edges of the wheels to cut just into the pipe's surface on opposite sides. Using the handle for leverage, workers rotate the tool, causing the steel wheels to cut a groove in an exact line around the pipe. To cut entirely through the pipe, workers repeatedly tighten the wheels and rotate the tool around the pipe.

To prepare pipes that will be screwed together, workers sometimes must thread pipes. Threads are the grooves that spiral around the ends of pipes either on the outside or the inside.

Workers thread pipes with a pipethreader, a tool similar to the pipecutter. The pipethreader has one or more steel cutting dies (like rows of teeth) pitched at an angle. Workers fasten this tool to the end of a pipe. As they rotate the threader around the pipe, the dies' pitched angle and sharp edges cause the threader to move along as it shaves a groove around the pipe.

Workers also may bend pipes to fit around obstructions. To bend a pipe, workers fasten it securely within a bending device at or near the point of the intended bend, then apply pressure to one end of the pipe.

When the pipes and other pieces are ready, workers install and connect them according to the instructions on blueprints. They may have to drill holes in ceilings, floors, and walls, or hang steel supports from ceilings to position the pipes properly.

After setting the pipes in place, workers connect them. They insert the end of a pipe into the slightly larger end of a valve or properly shaped connector. Workers then may use wrenches to screw threaded pipes tightly together, or may glue, solder, or weld connections to prevent leaks. To connect large pipes, such as those in buildings or industrial plants, workers bolt together the raised collars on the ends of pipes and valves.

Some plumbers and pipefitters specialize in gas, steam, or sprinkler fitting. Gasfitters install and maintain the fittings and extensions that connect gasline mains with the lines leading to homes. Steamfitters assemble and install steam or hot water systems for commercial and industrial uses. Sprinkler fitters install and maintain the piping for fire extinguishing systems.

Plumbers and pipefitters use wrenches, reamers, drills, braces and bits, hammers, chisels, saws, and other handtools. Power machines often are used to cut, bend, and thread pipes. Hand-operated hydraulic pipe benders also are used. In addition, plumbers and pipefitters use gas or acetylene torches and welding, soldering, and brazing equipment.

Places of Employment

Most plumbers and pipefitters—who numbered about 385,000 in 1976—work for plumbing and pipefitting contractors engaged in new construction activity, and work mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers install and maintain pipe systems for government agencies and public utilities, and some work on the construction of ships and aircraft. Others do maintenance work in industrial and commercial buildings. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-

Plumbing is one of the highest paying building trades.

processing industries where manufacturing operations include the processing of liquids and gases through pipes.

Training, Other Qualifications, and Advancement

Apprenticeship is the best way for plumbers or pipefitters to learn all aspects of these trades. A large number of people, however, learn plumbing and pipefitting by working for several years as helpers to experienced plumbers and pipefitters, and observing and receiving instruction from them.

Most apprenticeship programs for plumbers and pipefitters are sponsored through union-management agreements and usually consist of 5 years of on-the-job training, in addition to at least 216 hours annually of related classroom instruction. Subjects include drafting and blueprint reading, mathematics applicable to layout work, applied physics and chemistry, and local building codes and regulations.

On the job, helpers and apprentices begin with simple tasks such as carrying materials and cleaning up debris. In a short time they learn to measure and cut pipe, and later to bend, thread, and connect it. The most difficult form of connecting pipe is welding. This is taught toward the end of training. In the final phase of training, helpers and apprentices may learn to estimate costs.

Applicants for apprentice or helper jobs generally are required to be at least 16 years old and in good physical condition. A high school or vocational school education generally is recommended. Courses in chemistry, general mathematics, mechanical drawing, physics, and shop are helpful. Applicants may be given tests to determine whether they have the mechanical aptitude required in these trades. To obtain a plumber's or pipefitter's license, which some communities require, individuals must pass a special examination to demonstrate knowledge of the trade and of the local plumbing codes.

Some plumbers and pipefitters may become supervisors for plumbing and pipefitting contractors. Many go into business for themselves. As they expand their activities, they may employ other workers and become contractors. In most localities, contractors are required to obtain a master plumber's license.

Employment Outlook

Employment of plumbers and pipefitters is expected to grow faster than the average for all occupations through the mid-1980's. Thousands of job openings are expected because of employment growth and the need to replace plumbers and pipefitters who retire, die, or stop working for other reasons.

Employment is expected to grow mainly as a result of the anticipated increase in construction activity. Furthermore, plumbing will become more important in many types of construction. For example, a larger proportion of homes will have air-conditioning equipment, solar heating devices, and appliances such as washing machines and kitchen waste-disposal equipment. Chemical and petroleum refineries and coal gasification and nuclear powerplants, which use pipe extensively in their processing activities, are expected to expand, thus creating additional jobs for plumbers and pipefitters. Maintenance, repair, and modernization of existing plumbing or piping systems also will create employment opportunities.

Employment growth is expected to be fairly steady in the years ahead since plumbing and pipefitting are less sensitive to ups and downs in construction activity than are most other building trades.

Earnings and Working Conditions

According to a survey of metropolitan areas, union wage rates for plumbers and for pipefitters in 1976 averaged $10.40 an hour, or about twice the average wage for nonsupervisory and production workers in private industry, except farming. Apprentice wage rates start at 40 to 50 percent of the rate paid to experienced plumbers or pipefitters and increase as they gain experience. Annual earnings of workers in these fields are among the highest in the building trades because plumbing and pipefitting are affected less by bad weather and fluctuations in construction activity than are most other building trades.

Plumbing and pipefitting work is active and sometimes strenuous. These workers frequently must stand for long periods and occasionally work in cramped or uncomfortable positions. They risk the danger of falls from ladders, cuts from sharp tools, and burns from hot pipes. The injury rate for employees of plumbing, heating, and air-conditioning contractors in the construction industry has been about the same as the average for contract construction as a whole, but higher than the average for manufacturing.

Many plumbers and pipefitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada. Some plumbers and pipefitters who are contractors are members of the National Association of Plumbing-Heating-Cooling Contractors.

Sources of Additional Information

For information about apprenticeships or work opportunities in these trades, contact local plumbing, heating, and air-conditioning contractors; a local of the union mentioned above; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of plumbers, pipefitters, and sprinkler fitters, contact:

National Association of Plumbing-Heating-Cooling Contractors, 1016 20th St. NW., Washington, D.C. 20036.

National Automatic Sprinkler and Fire Control Association, P.O. Box 719, Mt. Kisco, N.Y. 10549.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, 901 Massachusetts Ave. NW., Washington, D.C. 20001.

ROOFERS

(D.O.T. 804.281, 843.844, and 866.381)

Nature of the Work

A leaky roof can cause damage to ceilings, walls, and furnishings. To keep out water, roofers apply materials such as asphalt, felt, shingles, slate, and tile to the roofs of buildings. These workers also waterproof walls and floors.

Roofers work with various kinds of roofing. To apply composition roofing, such as tar-and-gravel, roofers first measure, cut, and place strips of tarred felt over the entire surface. Next, they pour hot tar from a bucket and mop the tar over the felt and seams to seal them and make the surface watertight. They repeat the first two steps to build up the thickness of the tar. For the last coat, they use a broom like device to spread a hot mixture of thick tar over the surface. Finally, they add gravel, which sticks firmly to the tar.

When applying asphalt shingles, another type of composition roofing, roofers first lay, cut, and tack three-foot strips of roofing felt lengthwise over the entire roof. Then, starting from the bottom edge, they overlap and nail succeeding rows of asphalt shingles. Workers measure and cut the felt and shingles to fit around corners, pipes, and chimneys. Wherever two roof surfaces intersect, roofers cement or nail flashing (strips of felt or metal) over the joints to make them watertight.

A roofer's work may be especially hot during summer.

Roofers also use metal, tile, and slate. They build metal roofs by soldering together metal sheets and nailing them over the wood sheathing. To install tile and slate roofs, they place a covering of felt over the wood sheathing, punch holes in the slate or tile, and nail it to the sheathing. Each row of slate or tile overlaps the preceding row. Finally, roofers cover exposed nailheads with cement to prevent rust and water leakage. They use handtools such as hammers, roofing knives, mops, and calking guns.

Some roofers also waterproof and dampproof masonry and concrete walls and floors. To prepare surfaces for waterproofing, they hammer and chisel away rough spots or remove them with a rubbing brick before brushing on a coat of liquid waterproofing compound. They also may paint or spray surfaces with a waterproofing material or nail waterproofing fabric to surfaces. When dampproofing, they usually spray a coating of tar or asphalt on interior or exterior surfaces.

Places of Employment

About 90,000 roofers were employed in 1976. Most worked for roofing contractors on construction or repair jobs. Some worked for businesses and government agencies that do their own construction and repair work. A few roofers were self-employed.

Training, Other Qualifications, and Advancement

A 3-year apprenticeship program—usually sponsored by a local union-management committee—generally provides the most thorough training for this trade. However, the majority of roofers acquire their skills informally by working as helpers for experienced roofers.

Helpers learn the trade on the job. They start by carrying equipment and material and by erecting scaffolds. Within 2 or 3 months they are taught to measure, cut, and fit roofing materials such as felt. Soon, they are able to lay asphalt shingles. After a year or so, they learn to lay and fit tile, and eventually slate. Whether or not helpers learn to dampproof or waterproof depends upon the employer.

The apprenticeship program generally consists of a minimum of 1,400 hours of on-the-job training annually, in addition to 144 hours of classroom instruction in subjects such as blueprint reading, mathematics, and safety. On-the-job training for apprentices is similar to that for helpers, except that the apprenticeship program is broader and more structured. For example, apprentices work on specific areas of roofing for specified periods. They also learn to dampproof and waterproof.

For those interested in becoming roofers, a high school education or its equivalent is helpful, as are courses in mechancial drawing and basic mathematics. Good physical condition and a good sense of balance also are important assets. Applicants for apprenticeship programs must be at least 18 years old.

Roofers may advance to supervisor or to superintendent for a roofing contractor. Also, they may enter business for themselves and hire other roofers.

Employment Outlook

Employment of roofers is expected to increase faster than the average for all occupations through the mid-1980's. More roofers will be needed due to the longrun increase in construction activity. New construction and repairs on existing roofs will provide most of the work opportunities. Dampproofing and waterproofing, however, will provide an increasing proportion of roofers' work. Besides the job openings resulting from employment growth, some openings will arise from the need to replace experienced roofers who retire, die, or stop working for other reasons. Because construction activity fluctuates, however, job openings may be plentiful in some years, scarce in others. Jobs should be easiest to find during spring and summer since roofing work picks up as the weather becomes warmer.

Earnings and Working Conditions

In 1976, union roofers in metropolitan areas had estimated average

wages of $9.30 an hour, or about twice the average hourly rate paid to nonsupervisory or production workers in private industry, except farming. Yearly earnings for roofers and apprentices, however, generally are lower than hourly rates would indicate because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Apprentices usually start at 65 percent of the skilled roofer's pay rate and receive increases periodically.

Roofers' work is sometimes strenuous. It involves a lot of standing, as well as climbing, bending, and squatting. Roofers risk injuries from slips or falls from scaffolds or roofs, and may have to be outdoors in all types of weather, particularly when making repairs. The work may be especially hot during the summer months.

Many roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association.

Sources of Additional Information

For information about roofing apprenticeships or work opportunities in this trade, contact local roofing contractors; a local of the union previously mentioned; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or State apprenticeship agency.

For information about the work of roofers, contact:

National Roofing Contractors Association, 1515 N. Harlem Ave., Oak Park, Ill. 60302.

SHEET-METAL WORKERS

(D.O.T. 804.281 and .884)

Nature of the Work

Sheet-metal workers fabricate and install sheet-metal ducts for air-conditioning, heating, and ventilating systems; flat metal for kitchen walls and counters; and stamped metal for roofing and siding. Some workers specialize in either shopwork or on-site installation; others do both.

Some sheet-metal workers specialize in shopwork.

Sheet-metal workers fabricate much of the metal at the shop. Working from blueprint specifications, they measure, cut, bend, shape, and fasten most of the pieces that will be used on the job. Tapes are used for measuring; hand shears, hack saws, and power saws for cutting; and specially designed, heavy steel presses for cutting, bending, and shaping. Once the metal is measured and cut, workers then bolt, cement, rivet, solder, or weld the seams and joints together to form ducts, pipes, tubes, and other items.

At the construction site, sheet-metal workers usually just assemble and install pieces fabricated at the shop. Sometimes, however, workers make parts by hand at the worksite, using hammers, shears, and drills.

Workers install ducts, pipes, and tubes by joining them end to end and hanging them with metal braces secured to a ceiling or a wall. To hold the pieces together, workers sometimes bolt, glue, or solder the connections.

Molded and pressed sheet-metals, such as roofing and siding, usually are measured and cut on the job. After securing the first panel in place, workers interlock and fasten the grooved edge of the next panel into the grooved edge of the first. They nail the free edge of the panel to the structure. This two-step process is repeated for each additional panel. Finally, at joints, along corners, and around windows and doors, workers fasten machine-made molding for a neat, finished effect.

Places of Employment

Sheet-metal workers in the construction industry—who numbered about 65,000 in 1976—are employed mainly by contractors who specialize in heating, refrigeration, and air-conditioning equipment, and by general contractors engaged in residential, industrial, and commercial building. Additional sheet-metal workers are employed by government agencies or businesses that do their own construction and alteration work. Very few are self-employed.

Sheet-metal workers are employed throughout the country, but jobs are concentrated in metropolitan areas.

Training, Other Qualifications, and Advancement

Many sheet-metal workers have acquired their skills by working as helpers, observing and being taught by experienced workers. The majority, however, have learned through apprenticeship, which provides the most thorough training.

The apprenticeship program usually consists of 4 years of on-the-job training, in addition to related classroom instruction. On the job, apprentices learn to use the tools, machines, equipment, and materials of the trade. In the first 2 years, they learn to measure, cut, bend, fabricate, and install sheet-metal. They begin with duct work and gradually advance to fabricating decorative pieces. Toward the end of their training, they learn to use materials such as plastics and acoustical tile, which may be substituted for metal on some jobs. Classroom instruction covers subjects such as drafting, blueprint reading, mathematics, and first-aid. Safety is stressed throughout the program. In addition, apprentices learn the relationship between sheet-metal work and other construction work.

Workers who pick up the trade informally usually begin by carrying metal and cleaning up debris in a metal shop. While there, they learn about materials and their costs as well as tools and their uses. Then, as employers permit, helpers learn to set switches and operate levers on machines that bend or cut metal. In time, helpers leave the shop and go out on the job to learn installation.

Applicants for jobs as apprentices or helpers should be in good physical condition and have mechanical aptitude. Apprentices should have a high school or vocational school education or equivalent education. Courses in mathematics, mechanical drawing, and shop provide a helpful background for learning the trade.

Sheet-metal workers in construction may advance to supervisory jobs or may go into the contracting business.

Employment Outlook

Employment of sheet-metal workers in construction is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced workers retire, die, or leave work for other reasons.

As population and business grow, more sheet-metal workers will be needed to install air-conditioning and heating duct work and other sheet-metal products in new houses, stores, offices, and other buildings. The demand for air-conditioning systems in older buildings also will boost employment growth.

Athough employment is expected to increase over the long run, job openings may fluctuate from year to year due to ups and downs in construction activity. When construction activity is depressed, jobs for sheet-metal workers may be available in other industries.

Earnings and Working Conditions

Union sheet-metal workers in metropolitan areas had estimated average wages of $10.10 an hour in 1976. This is about twice the average for production and nonsupervisory workers in private industry, except farming. Sheet-metal apprentices generally start at 45 percent of the rate paid to experienced workers and receive periodic pay raises.

Many sheet-metal workers spend considerable time at the construction site, working either indoors or outdoors. Others work primarily in shops doing fabricating and layout work.

When installing gutters and skylights, they work high above ground. When installing ventilation and air-conditioning systems, they may work in awkward and cramped positions. Sheet-metal workers risk cuts and burns from materials and tools. The injury rate for workers in this trade is higher than the average for all construction workers.

A large proportion of sheet-metal workers are members of the Sheet Metal Workers' International Association.

Sources of Additional Information

For more information about apprenticeships or other work opportunities, contact local sheet-metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the union mentioned above; a local joint union-management apprenticeship committee; or the nearest office of the State employment service or apprenticeship agency.

For general information about sheet-metal workers, contact:

Sheet Metal and Air Conditioning Contractors' National Association, Inc., 8224 Old Courthouse Rd., Tyson's Corner, Vienna, Va. 22180.

TILESETTERS

(D.O.T. 861.781)

Nature of the Work

In ancient Egypt and Rome, tile was used for the design and construction of mosaics—an art form using small, decorative ceramic squares. Today, in a fashion similar to that of the ancient artists, tilesetters apply tile to floors, walls, and ceilings.

To set tile, which ranges in size from 1/2 inch to 6 inches square, workers in this trade use either cement or mastic (a very sticky paste). When using cement, tilesetters first must tack a support of screenlike mesh to the floor, wall, or ceiling. They mix a coarse cement, spread it onto the screen with a trowel, and,

About 1 out of 5 tilesetters is self-employed.

with a rakelike device, scratch the surface of the wet cement. After the cement has dried workers trowel on a richer coat of cement, working it back and forth in sweeping motions until it is smooth and even.

When using mastic to set tile, tilesetters need a flat, solid surface such as drywall or concrete. Workers spread the mastic with a tooth-edged metal trowel to create tiny ridges in the mastic. When the tile is set onto the ridges, it creates a suction that helps hold the tile.

Since tile is of various colors, shapes, and sizes, workers sometimes prearrange the tiles on a dry floor according to a specified design. This allows workers to examine the pattern and make any necessary changes.

Whether or not the tiles are prearranged, tilesetters place each tile onto the cement or mastic. Some tiles are cut with either a machine saw or a special cutting tool so they can fit into corners and around pipes, tubs, and wash basins. Once the tile is placed, tilesetters gently tap the surface of the tiles with a small block of wood so that all the tiles rest evenly and flatly.

When the cement or the mastic has "set" behind the tile, tilesetters use a rubber trowel to cover the tile and the joints with grout—a very fine cement mixture. They then scrape the surface with a rubber-edged device called a squeegee. This action safely removes grout from the face of the tiles, forces it into the joints, and removes any excess. Before the grout dries, workers wash the surface with water.

Places of Employment

Tilesetters—who numbered about 36,000 in 1976—are employed mainly in nonresidential construction projects, such as schools, hospitals, and public and commercial buildings. A significant proportion of tilesetters—about one out of five—are self-employed.

Tilesetters are employed throughout the country but are found largely in the more populated urban areas.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 3-year apprenticeship program as the best way to learn tilesetting. A substantial proportion of tilesetters, however, acquire their skills informally by working as helpers and being taught by experienced workers.

The apprenticeship program generally consists of on-the-job training and related classroom instruction in subjects such as blueprint reading, layout work, and basic mathematics.

Apprentices begin by learning the names of tools and how to use them. Within a short time they are taught to mix and apply cement, then to apply mastic. Later, they learn to cut tile and install it.

Those who learn informally generally receive less thorough training. They start by carrying supplies, cleaning work areas, and washing off the finished tile. Depending on the employer, a helper may learn to spread cement or mastic. Eventually, a helper is taught to cut and set tile.

When hiring apprentices or helpers, employers usually prefer high school or vocational school graduates who have had courses in general mathematics, mechanical drawing, and shop. Good physical condition, manual dexterity, and a good sense

of color harmony also are important assets.

Skilled tilesetters may become supervisors or start their own contracting businesses.

Employment Outlook

Employment of tilesetters is expected to increase about as fast as the average for all occupations through the mid-1980's. While employment growth will provide some new job opportunities, most will result from the need to replace tilesetters who retire, die, or leave the occupation for other reasons. Because tilesetters is a small occupation, however, there will be relatively few job openings annually.

Population and business growth is expected to cause an increase in the construction of houses and other buildings, thus increasing the demand for tilesetters. The trend toward two tile bathrooms or more in houses and apartments also will spur employment in this trade.

Earnings and Working Conditions

According to 1976 estimates of union wages in metropolitan areas, hourly rates for tilesetters averaged $9.35, or about twice the hourly rate paid to nonsupervisory and production workers in private industry, except farming. Hourly wage rates for apprentices start at about 50 to 60 percent of the rate paid to union workers and increase periodically.

Since tilesetters work mostly indoors, the annual number of hours they work generally is higher than some of the other contruction crafts. This difference may be reflected in added annual earnings.

The principal unions organizing these workers are the International Union of Bricklayers and Allied Craftsmen; and the International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters' Helpers and Marble Mosaic and Terrazzo Workers' Helpers.

Sources of Additional Information

For details about apprenticeship or other work opportunities in this trade, contact local tile setting contractors; locals of the unions previously mentioned; or the nearest office of the State employment service or State apprenticeship agency.

For general information about the work of tilesetters, contact:

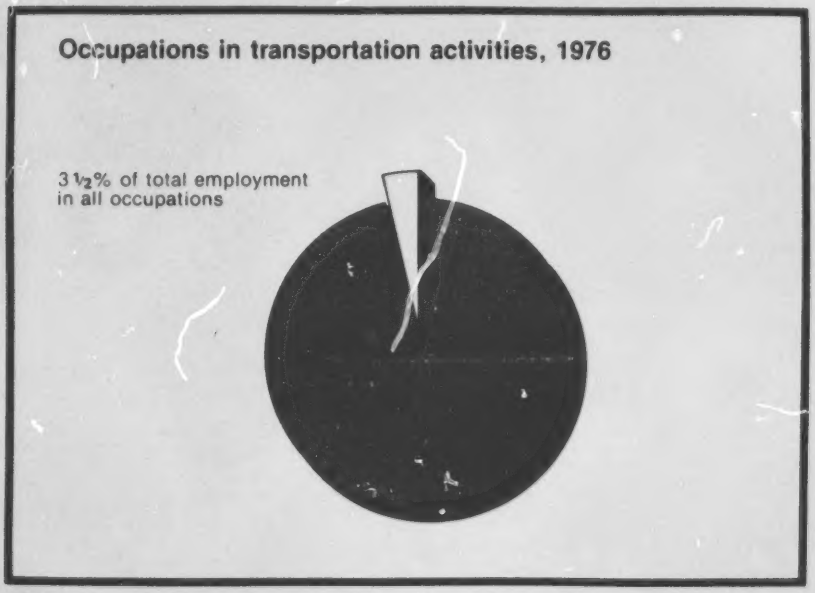
International Union of Bricklayers and Allied Craftsmen, International Masonry Apprenticeship Trust, 815 15th St. NW., Washington, D.C. 20005.

Tile Contractors' Association of America, Inc., 112 North Alfred St., Alexandria, Va. 22314.

OCCUPATIONS IN TRANSPORTATION ACTIVITIES

The transportation industries offer a wide range of career opportunities. Jobs in air, rail, highway, and water transportation vary from those that require little education to technical and administrative positions that require at least a college degree.

Although this field includes a variety of jobs, almost half of the workers provide transportation, by driving buses and trucks, flying aircraft, or operating trains and ships. The rest of the workers in this industry provide the countless support services that are needed. For example, some employees deal directly with customers—flight attendants and reservation agents assist passengers and railroad station agents arrange to transport cargo for businesses. Other workers, such as airplane mechanics, truck mechanics, and railroad shopworkers are needed to keep transportation equipment in good working condition.



As our economy expands and population grows, demand for freight and passenger service will rise, and more transportation workers will be needed. Employment trends will vary among the different modes of transportation, however. Employment in most air and highway transportation jobs will increase, while employment in the merchant marine and most jobs within the railroad industry will decline. Even in most declining occupations, however, new workers will be hired to replace those who retire, die, or transfer to other fields.

The transportation occupations mentioned in this introduction, as well as many more, are described in detail in the following sections.

AIR TRANSPORTATION OCCUPATIONS

Air transportation offers excellent opportunities for persons of varying skills, training, and experience. Working conditions generally are good and the pay is fairly high. Many employees have an opportunity to travel, either on the job or because they are entitled to fly at reduced fares on most airlines.

Through the mid-1980's, employment in air transportation occupations as a whole is expected to grow as the number of planes increases. In addition to job openings created by growth, many new employees will be hired to replace those who retire, die, or stop working for other reasons.

The individual statements that follow describe the occupations most closely associated with flying: airplane pilots, flight attendants, airplane mechanics, air traffic controllers, and reservation, ticket, and passenger agents.

AIR TRAFFIC CONTROLLERS

(D.O.T. 193.168)

Nature of the Work

Air traffic controllers are the guardians of the airways. Controllers keep track of planes flying within their assigned area, giving pilots instructions that will keep the planes separated. Their immediate concern is safety, but within this framework, controllers must direct planes efficiently to minimize delays. Some regulate airport traffic; others regulate flights between airports.

From the control tower, airport traffic controllers can see the planes that are on the ground and in the air nearby. Planes that are farther away or at a higher altitude show up on the radar screen. As planes approach an airport, pilots radio ahead to inform the tower of their presence and request permission to land. If the way is clear, controllers direct the pilots to a runway; if the airport is busy, controllers fit the plane into a traffic pattern with other aircraft waiting to land. They also provide pilots with information about conditions at the airport, such as the weather, the speed and direction of the wind, and the visibility. Controllers constantly observe the planes under their direction, and if a controller notices that two planes are on a collision course, one of the pilots will be instructed to turn or change altitude.

A similar procedure is used for takeoffs. If necessary, a temporary break in traffic is arranged, the plane is instructed to depart, and a controller observes it on radar to guide the pilot around other planes.

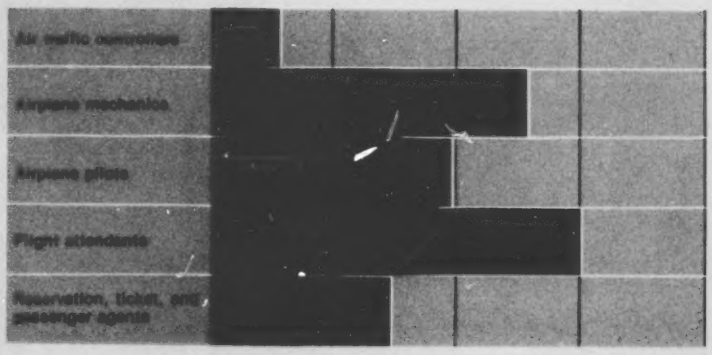
After each plane departs, airport traffic controllers notify the enroute controllers who will be next to take charge. There are 25 enroute control centers located around the country. Enroute controllers work in teams of two or three. Because airplanes generally fly along specially designated routes, each team is assigned a certain amount of airspace along one of these routes. A team, for example, might be responsible for all planes that are between 30 to 100 miles north of the airport and flying at an altitude between 6,000 and 18,000 feet.

When a plane enters a team's airspace, one controller communicates with the pilots by radio and follows the plane's flight path on radar. The remaining team members prepare for other planes about to enter their area by communicating with neighboring control towers and adjacent centers, and organizing flight plans coming over teletype machines and computer displays. These plans were filed by pilots and provide controllers with information such as when a plane will enter the team's airspace and at what altitude.

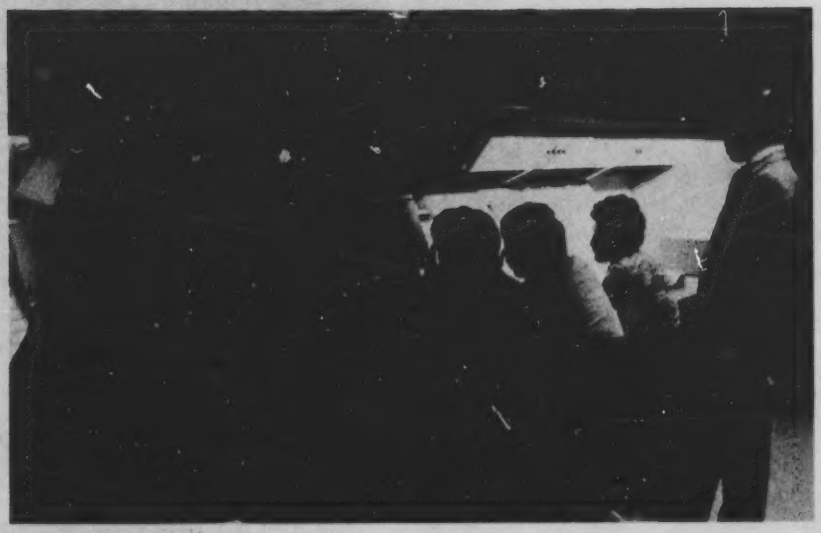
Enroute controllers also warn pilots about nearby planes, bad weather conditions, and other possible hazards. If two planes are on a collision course they will be directed around each other. Or if a pilot wants to

Keen competition is expected for the relatively small number of openings in air transportation occupations

Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics



Controllers coordinate flight activities to prevent accidents and expedite takeoffs and landings.

change altitude in search of better flying conditions, the controller will check to determine that no other planes will be along the proposed path during the altitude change.

As the flight progresses, the team responsible for the aircraft notifies the next team that will be in charge. Through this coordination, one team after another watches over the plane until it safely arrives at its destination.

Controllers usually have several planes under their control at one time, and often have to make quick decisions about completely different activities. For example, an airport controller might be directing a plane on its landing approach, and at the same time be providing pilots just entering the airport's airspace with information about conditions at the airport. While instructing these pilots, the controller also would be observing other planes in the vicinity, such as those in a holding pattern waiting for permission to land, to determine that they remain well separated.

Places of Employment

The sole employer of civilian air traffic controllers is the Federal Aviation Administration (FAA). About 21,000 persons worked as air traffic controllers in 1976, mostly at major airports and air route traffic control centers located near large cities.

Training, Other Qualifications, and Advancement

Air traffic controller trainees are selected through the competitive Federal Civil Service System. Applicants must be less than 31 years old and must pass a written test that measures their ability to learn and perform the controller's duties. In addition, applicants must have 3 years of general work experience or 4 years of college, or a combination of both. Applicants with sufficient experience as military controllers, pilots, or navigators may be hired without taking the written test. Applicants must be in excellent health and have vision correctable to 20/20.

Potential controllers should be articulate, since directions to pilots must be given quickly and clearly. A quick and retentive memory also is important because controllers constantly receive information about the planes under their direction which they must immediately grasp, interpret, and remember for a short period. A decisive personality is an asset, since controllers often have to make rapid decisions.

Successful applicants receive a combination of on-the-job and formal training to learn the fundamentals of the airway system, Federal aviation regulations, controller equipment, and aircraft performance characteristics. They receive approximately 16 weeks of intensive training, including practice on simulators, at the FAA Academy in Oklahoma City. It usually takes 2 to 3 years of progressively more responsible work experience to become a fully qualified controller. Each year, controllers must pass a physical examination; they must pass a job performance examination twice each year.

Controllers can transfer to jobs at different locations and advance to supervisory positions. Some advance to more responsible management jobs in air traffic control and a few to top administrative jobs in the FAA.

Employment Outlook

Employment of air traffic controllers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to openings resulting from growth, many others will arise as experienced controllers retire, die, or leave the occupation for other reasons. Competition for jobs should be keen, however, because the number of qualified applicants is expected to be much greater than the number of openings.

As the number of aircraft increases, the skyways will become more congested and more controllers will be needed. Also, to prevent collisions, the FAA has created spaces near certain airports and above certain altitudes which require all pilots to receive directions from air traffic controllers. If, as expected, the number and size of these spaces are expanded, additional controllers will be needed despite the greater use of new, automated control equipment.

College graduates who have civilian or military experience as controllers, pilots, or navigators, will have the best employment opportunities.

Earnings and Working Conditions

In 1976 controller trainees earned $11,500 a year; the average earnings for all controllers was $22,300 a

year, or over twice the average for all nonsupervisory workers in private industry, except farming. Depending on length of service, they receive 13 to 26 days of paid vacation and 13 days of paid sick leave each year, life insurance, health benefits, and, due to the stress involved in the work, a more liberal retirement program than other Federal employees.

Controllers work a basic 40-hour week; however, they may work additional hours for which they receive overtime pay or equal time off. Because control towers and centers must be operated 24 hours a day, 7 days a week, controllers are assigned to night and weekend shifts on a rotating basis.

Air traffic controllers sometimes work under great stress. They must keep track of several planes at the same time and make certain all pilots receive correct instructions.

Many controllers belong to the Professional Air Traffic Controllers Organization.

Sources of Additional Information

A pamphlet providing general information about controllers and instructions for submitting applications is available from any U.S. Civil Service Commission Job Information Center. Look under U.S. Government, Civil Service Commission, in your telephone book to obtain a local Job Information Center telephone number and call for a copy of Announcement 418. If there is no listing in your telephone book, dial the toll-free number 800-555-1212 and request the toll-free number of the U.S. Civil Service Commission Job Information Center for your location.

AIRPLANE MECHANICS

(D.O.T. 621.281)

Nature of the Work

Today most travelers hardly think twice about flying thousands of feet above the ground. The confidence travelers have in airplanes is a tribute to the mechanics who maintain them. Airplane mechanics perform scheduled maintenance, make repairs, and complete inspections required by the Federal Aviation Administration (FAA).

In order to keep planes in top operating condition, many mechanics specialize in scheduled maintenance. Using a schedule that is based on the number of flight hours, calendar days, or a combination of these factors, the planes are inspected and necessary maintenance is performed. Mechanics may examine engines through specially designed openings, working from ladders or scaffolds, or use hoists or lifts to remove the entire engine from the planes. Mechanics may take engines apart, measure the parts for wear with delicate instruments, check for invisible cracks with X-ray and magnetic inspection equipment, and replace worn parts. They also may repair sheet-metal surfaces, measure the tension of control cables, or check for rust, distortion, and cracks in parts of fuselages and wings. After making repairs, mechanics test the equipment to make sure the repairs were made properly.

Some mechanics specialize in repair work and use the pilot's description of a problem to find and fix faulty equipment. For example, during the pre-flight check of the airplane, a pilot may discover that the gas gauge does not work. To solve the problem, mechanics may check the electrical connections, replace the gauge, or use electrical test equipment to make sure no wires are broken or shorted. They work as fast as safety permits so that the plane can be put back into service quickly.

Mechanics may work on many types of airplanes, on one type of plane, or they may specialize in working on one section of the plane, such as engines or electrical systems. At small airports, mechanics usually make all kinds of inspections and repairs on many different types of aircraft.

Places of Employment

About 110,000 airplane mechanics were employed in 1976, not including about 30,000 who worked in aircraft manufacturing firms assembling airplanes. Over one-half worked for airlines and about one-third worked for the Federal Government. The rest were general aviation mechanics, most of whom worked for small repair shops or companies that operate their own planes to transport executives and cargo.

Most airline mechanics work near large cities at the airlines' main stops. Many employees of the Federal Government are civilians employed by the military and work at large military bases. Others work for the FAA, many in the headquarters at Oklahoma City. Mechanics for small repair shops work at airports in every part of the country.

Training, Other Qualifications, and Advancement

The majority of mechanics who work on civilian aircraft are licensed by the FAA as "airframe mechanics," "powerplant mechanics," or "aircraft inspectors." Airframe mechanics are qualified to work on the fuselage, wings, landing gear, and other structural parts of the plane, while powerplant mechanics are qualified only for work on the engine. Combination airframe-and-powerplant mechanics can work on any part of the plane, and those with an inspector's license can certify inspection work completed by other mechanics. Unlicensed mechanics are supervised by those with licenses.

At least 18 months of work experience are required for an FAA airframe or powerplant license; for a combined license, at least 30 months of experience working with both engines and airframes are required. To obtain an inspector's license, a mechanic must have held an airframe-and-powerplant license for at least 3 years. Applicants for all licenses also must pass written and oral tests and give practical demonstrations of their ability to do the work authorized by the license.

Most mechanics learn their job in the Armed Forces or in trade schools certified by the FAA. Courses in these trade schools last about 2 years and provide training with the tools and equipment mechanics will use on the job. Attendance at such schools may be used as a substitute for work experience when applying for an

The confidence travelers have in airplanes is a tribute to the mechanics who maintain them.

FAA license. However, these schools do not guarantee students jobs or FAA licenses. People who were aircraft mechanics in the Armed Forces usually have earned credit towards the work experience and other requirements of the license. They usually attend a shorter program at one of the trade schools to learn the material specific to civilian aircraft, before taking the licensing test.

A few people become mechanics through on-the-job training. For these trainee jobs, employers prefer high school graduates who are in good physical condition. Experience in automotive repair or other mechanical work is helpful.

Courses in mathematics, physics, chemistry, and mechanical drawing are helpful for all prospective mechanics because knowledge of the principles involved in the operation of an aircraft often is necessary in order to learn how to make repairs.

Aircraft mechanics must be able to do detailed work and have the strength to lift heavy parts and tools. Agility is important for the reaching and climbing that are necessary to the job. Aircraft mechanics must be willing to work in high places, such as on the top of wings and fuselages on large jet planes.

As aircraft mechanics gain experience, they can advance to more responsible jobs. Opportunities are best for those who have an airframe-and-powerplant license, as well as an aircraft inspector's license. The avenue of advancement usually is mechanic to head mechanic (or crew chief), to inspector, to head inspector, to shop supervisor. In airline companies, a few supervisors may advance to executive positions. With additional business training, some may open their own repair shops.

Employment Outlook

The number of aircraft mechanics is expected to increase faster than the average for all occupations through the mid-1980's. In addition to jobs resulting from growth, many job openings will result from the need to replace mechanics who transfer to other fields of work, retire, or die. However, job opportunities in general aviation, airline companies, and the Federal Government will differ.

Job opportunities in general aviation are expected to be good. The number of aircraft used by companies for executive transportation is expected to grow rapidly, thus increasing the demand for mechanics. Since wages in small companies frequently are low, there is less competition for jobs than in the airlines. Also, some additional jobs will become available as experienced mechanics leave for better paying jobs

with airlines or large private companies. Although employers in general aviation prefer applicants with an airframe-and-powerplant license from the FAA, some trainee jobs are available.

In contrast with general aviation, competition for airline jobs will be keen because the high wages attract more qualified applicants than there are jobs available. A growing population and rising incomes are expected to increase the demand for airline transportation and, as airlines add more planes to meet this demand, more mechanics will be needed. However, the introduction of larger planes, combined with the recent slowdown in air traffic, has led to a temporary decrease in the need for airline mechanics. Therefore, in the near future, many of the new jobs will be taken by experienced airline mechanics now on furlough.

Little change in the number of mechanics employed by the Federal Government is expected. Opportunities will fluctuate with changes in defense spending.

Earnings and Workings Conditions

In 1976, annual earnings of airline mechanics averaged $23,061, about 2 1/2 times the average for all nonsupervisory workers in private industry, except farming. As an additional benefit, airline mechanics and their immediate families receive reduced fare transportation with their own and most other airlines.

Mechanics usually work in hangars or in other indoor areas. However, when repairs must be made quickly, they may work outdoors. Mechanics sometimes must stand or lie in awkward positions when making repairs. Work areas are noisy when engines are being tested.

Mechanics employed by most major airlines are covered by union agreements. The principal unions in this field are the International Association of Machinists and Aerospace Workers and the Transport Workers Union of America. Some mechanics are represented by the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

For general information about airplane mechanics, write to:

Aviation Maintenance Foundation, P.O. Box 739, Basin, Wyo. 82410.

Information about jobs in a particular airline may be obtained by writing to the personnel manager of the company. For addresses of airline companies, write to:

Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

For information on jobs in a particular area, contact employers at local airports or local offices of the State employment service.

AIRPLANE PILOTS

(D.O.T. 196.168, .228, .268, and .283)

Nature of the Work

Pilots are skilled, highly trained professionals who fly planes to carry out a wide variety of tasks. Although most pilots transport passengers and cargo, many others perform tasks such as crop dusting, inspecting power lines, and taking photographs.

Except on small aircraft, two pilots usually are needed to fly the plane. Generally, the most experienced pilot (called captain by the airlines) is in command and supervises any other crew members on board. The copilot assists in communicating with air traffic controllers, monitoring the instruments, and flying the plane. Most large airliners have a third pilot in the cockpit who serves as flight engineer. The flight engineer assists the other pilots by monitoring and operating many of the instruments, making minor inflight repairs, and looking out for other aircraft.

Before departure, pilots plan their flights carefully. They confer with dispatchers and weather forecasters to find out about weather conditions on route and at their destination. Based on this information, they choose a route, altitude, and speed that will give a fast, safe, and smooth flight. It is the responsibility of the pilot in command to inform air traffic control of the flight plan so that the flight can be coordinated with other air traffic.

Before taking off, pilots thoroughly check their planes to determine that the engines, controls, instruments, and other components are working properly. They also make sure that baggage or cargo has been loaded correctly.

Takeoff and landing are the most difficult parts of the flight and require close coordination between the pilot and copilot. For example, as the plane accelerates for takeoff, the pilot concentrates on the runway while the copilot scans the instrument panel. The pilots already have calculated the speed they must attain to become airborne, taking into account the altitude of the airport, the weight of the plane, and the speed and direction of the wind. The moment the plane reaches this speed, the copilot informs the pilot who then pulls back on the controls to raise the nose of the plane.

Unless the weather is bad, the actual flight is relatively easy. Pilots steer the plane along their planned route, and radio their position, air speed, and other flight details to the air traffic control stations they pass along the way. They continuously scan the instrument panel to check their fuel and the condition of their engines. Pilots may request a change in altitude or route if circumstances dictate. For example, if the weather briefing led the pilots to expect a smoother ride than is being experienced, they may ask air traffic control if pilots flying at other altitudes have reported better conditions. If so, they may request a change. This procedure also may be used to find a stronger tailwind or a weaker headwind to save fuel and increase speed.

If visibility is poor, pilots must rely completely on their instruments. Using the readings on the altimeter, they know how high above ground they are and can fly safely over mountains and other obstacles. A special navigation radio gives pilots information which, with the help of special maps, tells them their exact position. Other, very sophisticated

Before takeoffs, pilots make sure all equipment is working properly.

equipment provides directions to a point just above the end of a runway and enables pilots to land completely "blind."

Once on the ground, pilots must complete records on their flight for their company and the Federal Aviation Administration (FAA).

Airline pilots have the services of large support staffs and consequently perform few nonflying duties. Pilots employed by businesses that use their own aircraft, however, usually are the businesses' only experts on flying and consequently have many other duties. For example, since pilots understand the requirements for a balanced plane, the business pilot loads the plane and handles all passenger luggage. While the plane is being refueled, the business pilot stays with it to assure that the job is done properly. Other nonflying responsibilities include keeping records, scheduling flights and major maintenance, and performing minor maintenance and repair work on their planes. Some pilots are instructors and spend much of their time giving flying lessons. They teach their students the principles of flight in ground school classes and demonstrate how to operate the aircraft in "dual-controlled" planes. A few specially trained pilots are "evaluators" or "check pilots." They fly with each airline pilot and copilot at least twice a year to make sure that they are proficient.

Places of Employment

About 83,000 civilian pilots worked full time in 1976. About one-half worked for the airlines. Much of the remainder worked as flight instructors at local airports or for large businesses that use their own airplanes to fly company cargo and executives. Some pilots flew small planes for air taxi companies, usually flying passengers to or from lightly traveled airports not serviced by the airlines. Others worked for a variety of businesses performing tasks such as crop dusting, inspecting pipelines, or conducting sightseeing trips. Federal, State, and local governments also employed pilots.

Most pilots work at the major airports located close to cities. In fact, over one-third of all pilots work near seven metropolitan areas—Los Angeles, San Francisco, New York, Dallas-Fort Worth, Chicago, Miami, and Atlanta.

Training, Other Qualifications, and Advancement

All pilots who are paid to transport passengers or cargo must have at least a commercial pilot's license from the FAA. To qualify for this license, applicants must be at least 18 years old and have at least 250 hours of flight experience. They also must pass a strict physical examination to make sure that they are in good health, have 20/20 vision with or without glasses, good hearing, and no physical handicaps that prevent quick reactions. Applicants must pass a written test that includes questions on the principles of safe flight, navigation techniques, and FAA regulations; and demonstrate their flying ability to FAA examiners.

In addition to a commercial license, pilots who want to fly in bad weather must be licensed by the FAA to fly by instruments. Pilots may qualify for this license by having 40 hours of experience flying by instruments, passing a written examination on procedures and FAA regulations covering instrument flying, and demonstrating their ability to fly by instruments.

Airline pilots must fulfill additional requirements. They must pass FAA written and flight examinations to earn a flight engineer's license. Captains must have an airline transport pilot's license. Applicants for this license must be at least 23 years old and have a minimum of 1,500 hours of flying experience during the previous 8 years, including night and instrument flying.

All licenses are valid as long as a pilot can pass the required physical examinations and the periodic tests of flying skills demanded by government regulations.

Flying can be learned in military or civilian flying schools. Either kind of training satisfies the flight experience requirements for licensing, but persons serving in the Armed Forces have the opportunity to gain the substantial experience on jet aircraft that is preferred by airlines and many businesses.

Pilots hired by airlines must be high school graduates; however, most airlines require 2 years of college and prefer to hire college graduates. Because pilots must be able to make quick decisions and accurate judgments under pressure, airline companies give all applicants psychological tests and reject those who do not pass.

New airline pilots usually start as flight engineers. Although airlines favor applicants who already have a flight engineer's license, they may train those who have only the commercial license. All new pilots receive several weeks of intensive training in simulators and classrooms before being assigned to a flight.

Companies other than airlines generally do not require as much flying experience. However, a commercial pilot's license is required and companies prefer applicants who have experience in the type of plane they will be flying. New employees generally start as copilots.

Advancement for all pilots generally is limited to other flying jobs. Many pilots start as flight instructors, building up their flying hours while they teach. As they become more experienced, these pilots occasionally may have the opportunity to fly charter planes and perhaps get jobs with small air transportation firms such as air taxi companies. Some advance to business flying jobs. Only a small number get flight engineer jobs with the airlines because the airlines prefer pilots who have been trained in the military.

In the airlines, advancement usually depends on seniority provisions established by union contracts. After 5 to 10 years, flight engineers advance according to seniority to co-pilot and, after 10 to 20 years, to captain. Seniority also determines which pilots get the more uesirable routes. In non-airline jobs, copilots may advance to pilot and, in large companies, to chief pilot in charge of aircraft scheduling, maintenance, and flight procedures.

Employment Outlook

Employment of pilots is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the jobs from employment growth, openings will result as experienced pilots die or retire. Competition for job openings should be keen, however, because the number of qualified pilots seeking jobs is expected to exceed the number of openings.

More than half the openings for pilots will occur outside the airlines. Businesses are expected to operate an increasing number of planes and employ more pilots to fly executives and cargo to locations that the scheduled airlines do not service. More flight instructors also will be needed to train new pilots.

The expected growth in airline passenger and cargo traffic will create a need for more airliners and more pilots to fly them. The short term outlook, however, is poor. The recent slowdown in air travel combined with the introduction of bigger planes has caused a temporary decrease in the need for airline pilots. Therefore, many of the new jobs that do develop will be taken by experienced airline pilots now on furlough.

Recent college graduates who have experience flying large, multiengine aircraft and who have a commercial pilot's license and a flight engineer's license can expect first consideration for jobs with the major airlines. Businesses generally have fewer formal education and experience requirements than airlines. However, these companies prefer applicants with flying experience in the type of plane they will be flying on the job.

Earnings and Working Conditions

Earnings of airline pilots are among the highest in the Nation. In 1976, the average salary for airline pilots was $46,253 a year. Starting salaries for flight engineers averaged $9,000 a year, while some senior captains on the largest aircraft earned more than $80,000. Earnings depend on factors such as the type, size, and speed of the planes, and the number of hours and miles flown. Extra pay is given for night and international flights. As an additional benefit, pilots and their immediate families usually are entitled to a limited amount of reduced fare transportation on their own and other airlines.

Earnings of business pilots ranged from $10,000 for copilots on small planes to $45,000 for chief pilots of companies with large jets. Most business pilots flying single-engine planes made from $14,200 to $19,000 a year while salaries of those flying jets ranged from $16,500 to $29,500. Most flight instructors made between $7,000 and $16,000 a year while annual salaries for air taxi pilots ranged from $12,000 to $17,000.

By law, airline pilots cannot fly more than 85 hours a month. Most airline pilots actually fly less than 70 hours a month and, although they have additional nonflying duty hours, usually only work 16 days a month. However, the majority of flights involve layovers away from home. When pilots are away from home, the airlines provide hotel accommodations and an allowance for expenses. Airlines operate flights at all hours of the day and night, so work schedules often are irregular. Pilots with little seniority may be assigned night or early morning flights.

Pilots employed outside the airlines often have irregular schedules; they may fly 30 hours one month and 90 hours the next. Since these pilots frequently have many nonflying responsibilities, they have much less free time than airline pilots. With the exception of business pilots, most pilots employed outside the airlines do not remain away from home overnight. They may work odd hours,

however. Instructors, for example, often give lessons at night or on weekends.

Although flying does not involve much physical effort, the mental stress of being responsible for a safe flight, no matter what the weather, can be very tiring. Particularly during takeoff and landing, pilots must be alert and ready to act if something goes wrong.

Most airline pilots are members of the Air Line Pilots Association, International. Those employed by one major airline are members of the Allied Pilots Association.

Sources of Additional Information

Information about job opportunities in a particular airline, and the qualifications required, may be obtained by writing to the personnel manager of the airline. Addresses of airline companies are available in the booklet *The People of the Airlines*. For a copy, write to:

Public Relations Department, Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

For information about the duties, as well as the physical and educational requirements for airline pilots, contact:

Air Line Pilots Association, International, 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

For information about job opportunities in companies other than airlines, consult the classified section of aviation trade magazines and apply to companies that operate aircraft at local airports.

FLIGHT ATTENDANTS

(D.O.T. 352.878)

Nature of the Work

Flight attendants (also called stewardesses and stewards) are aboard almost all commercial passenger planes to help make the passengers' flight safe, comfortable, and enjoyable.

Before each flight, attendants see that the passenger cabin is in order. They check that supplies such as food, beverages, blankets, and reading material are adequate, and that first aid kits and other emergency equipment are aboard. As passengers come aboard, attendants greet them, check their tickets, and assist them by hanging up coats and stowing small pieces of luggage under the seats.

Before the plane takes off, attendants use the public address system to instruct passengers in the use of emergency equipment and check to see that all passengers have their seat belts fastened. In the air, they answer questions about the flight, distribute magazines and pillows, and help care for small children, elderly persons, and handicapped persons. On many flights, they serve cocktails and precooked meals.

One of the most important functions of attendants is to assist passengers in the rare event of an emergency. These range from a disabled engine, where passengers must be reassured, to emergency landings, where attendants evacuate the plane, opening doors and inflating emergency slides. Attendants also must be prepared to administer first aid to passengers who become ill during the flight.

Places of Employment

About 42,000 flight attendants worked for the airlines in 1976. Most attendants are stationed in major cities at the airlines' main bases; nearly three-fifths work near Chicago, Dallas, Los Angeles, Miami, New York, and San Francisco. Airliners generally carry 1 to 10 flight attendants, depending on the number of seats on the plane and the proportion of economy to first-class passengers. Large aircraft like the Boeing 747 may have as many as 16 flight attendants.

Training, Other Qualifications, and Advancement

The airlines place great stress on the hiring of poised, tactful, and resourceful people. In particular, applicants should be able to talk comfortably with strangers. As a rule, applicants must be at least 19 years old. They must be in excellent health

Most airlines provide a 5-week training course for newly hired attendants.

and have good vision. Vision may be corrected with contact lenses or, on most airlines, with glasses. Applicants also must speak clearly.

Applicants must be high school graduates. Those having 2 years of college, nurses' training, or experience in dealing with the public are preferred. Flight attendants for international airlines generally must be able to speak an appropriate foreign language fluently.

Most large airlines give newly hired flight attendants about 5 weeks of training in their own schools. Transportation to the training centers and an allowance while in training may be provided. Trainees are taught how to react to emergencies, including instruction on evacuating an airplane, operating an oxygen system, and giving first aid. Attendants also are taught flight regulations and duties, and company operations and policies. Additional courses in passport and customs regulations are given to trainees for the international routes. Towards the end of their training, students go on practice flights. The few airlines that do not operate schools generally send new employees to the school of another airline.

After completing their training, flight attendants are assigned to one of their airline's main bases. New attendants usually fill in on extra flights or replace attendants who are sick or on vacation. Because assignments are based on seniority, experienced attendants usually get their choice of base and flights.

Opportunities for advancement are limited. However, some attendants may advance to flight service instructor, customer service director, instructor, or recruiting representative.

Employment Outlook

Employment of flight attendants is expected to grow much faster than the average for all occupations through the mid-1980's. In addition to growth, openings will occur because of the need to replace experienced attendants who retire, die, or transfer to other occupations.

Increases in population and income are expected to increase the number of airline passengers. To deal with this growth, airlines usually enlarge their capacity by increasing the number and size of planes in operation. Since the Federal Aviation Administration safety rules require one attendant for every 50 seats, more flight attendants will be needed. Job opportunities may vary from year to year, however, because air travel is sensitive to ups and downs in the economy.

Because the job is attractive and offers a chance to travel, many people are interested in becoming flight attendants. Applicants can expect keen competition for any available jobs because the number of applicants is expected to exceed the number of openings. Applicants with 2 years of college and experience in dealing with the public have the best chance of being hired.

Earnings and Working Conditions

The average monthly earnings of all flight attendants were $1,042 in 1976. According to a number of union contracts, salaries of most beginning flight attendants on domestic flights ranged from $690 to $780 a month, while those on international flights earned from $830 to $980. As an additional benefit, flight attendants and their immediate families are entitled to reduced fare transportation on their own and most other airlines.

Since airlines operate around the clock 365 days a year, attendants may work at night, on holidays, and on weekends. They usually fly no more than 80 hours a month, but they may devote up to 35 hours a month on the ground duties involved in preparing their planes for flights. As a result of variations in scheduling and limitations on flying time, many attendants have 15 days or more off each month. Attendants may be away from their home bases about one-third of the time or more. When they are away from home, the airlines provide hotel accommodations and an allowance for meal expenses.

Flight attendants have the opportunity to meet interesting people and see new places. The combination of free time and discount air fares provides substantial opportunity for travel. However, the work can be strenuous and trying. Many short flights require speedy service if all passengers are to be served. Poor weather can make it difficult to serve drinks and meals. Attendants stand during much of the flight and must remain pleasant and efficient regardless of how tired they may be.

Most flight attendants are members of either the Transport Workers Union of America or the Association of Flight Attendants.

Sources of Additional Information

Information about job opportunities in a particular airline and the qualifications required may be obtained by writing to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

RESERVATION, TICKET, AND PASSENGER AGENTS

(D.O.T. 912.368 and 919.368)

Nature of the Work

In any company, the attitude with which employees deal with the public and the quality of the service they provide often make the difference between a satisfied or dissatisfied customer. In airline companies, this important personal contact with the public is provided by reservation, ticket, and passenger agents. These employees reserve seats, sell tickets, and help passengers board planes.

Reservation agents work at large central offices and give customers information on flight schedules and fares over the telephone. After finding out where a customer wants to go, when, and from which airport he

or she wants to leave, agents check to find out if a seat is available. Computers are used to keep track of flight space information so that agents at all reservation offices can quickly find this out.

If the plane is full, the agent may suggest an alternate flight or check with other airlines flying to the same destination. If the customer makes a reservation, the agent types his or her name and other information into the computer to prepare a ticket and reserve the space.

Ticket agents work in the airlines' downtown ticket offices or at airports. In addition to answering questions about schedules and making reservations, these agents fill out the ticket forms with the flight number, passenger's name and destination, and other necessary information. At airports and a few downtown offices they also tag passengers' luggage for shipment on the plane.

Passenger agents work only at airports and may spend much of their time helping ticket agents give information, prepare tickets, and check baggage. However, they also help passengers board planes. These agents may use the public address system to tell passengers when and where to board. At the gates, agents collect tickets and, on some flights, assign seats as well. Passenger agents also keep records of passengers on each plane and assist customers with problems such as lost or damaged baggage.

During holidays and other busy periods, ticket and passenger agents especially may find the work hectic due to the large number of passengers who must be rapidly accommodated.

Places of Employment

About 51,000 reservation, ticket, and passenger agents were employed in 1976. Most worked in downtown ticket and reservation offices and at large metropolitan airports where most airline passenger business originates. Some are employed in smaller communities served by airlines.

Training, Other Qualifications, and Advancement

Because reservation, ticket, and passenger agents must deal directly with the public, airlines have strict hiring standards concerning appearance, personality, and education. A good speaking voice is essential because these employees frequently use the telephone or public address systems. High school graduation generally is required, and some college training is preferred.

New employees begin as reservation or ticket agents. They usually receive about a week of classroom instruction to learn how to use the flight schedule book and the computer to get information on flights and make ticket reservations. They also learn how to handle customers courteously. After completing the classroom instruction, new employees receive on-the-job training from experienced workers. About 3 weeks of experience are needed before an employee is able to handle the job without close supervision.

Advancement opportunities are limited. Reservation and ticket agents may become passenger agents; passenger agents may advance to supervisory positions. A few eventually may become city and district managers for airline ticket offices.

Employment Outlook

Employment of reservation, ticket, and passenger agents is expected to grow faster than the average for all occupations through the mid-1980's. In addition to jobs that result from growth, many openings will arise as experienced workers retire, die, or transfer to other jobs. Opportunities for employment may fluctuate from year to year, however, since the number of airline passengers varies with ups and downs in the economy. Applicants may find considerable competition for openings because a large number of people are attracted to airline jobs.

More agents will be needed because of the anticipated increase in airline passengers. Although airlines are installing machines to process reservations, keep records, and perform other routine tasks, machines cannot replace the personal contact that is an important part of a reservation, ticket, or passenger agent's job.

Computers are used to keep track of flight reservation information.

Earnings and Working Conditions

Passenger agents had estimated weekly earnings of $322 in 1976, according to a survey of 21 airlines. Ticket agents averaged $311 a week while reservation agents averaged $294. These earnings ranged from about one-third to one-half more than the average for all nonsupervisory workers in private industry, except farming. As an added benefit, agents and their immediate families are entitled to reduced fare air transportation with their own and many other airlines.

Agents generally work 40 hours a week. Airlines operate flights at all hours of the day and night, however, and work schedules are irregular. Agents with little seniority may work nights and weekends.

Many agents belong to labor unions. Four unions cover most of the organized agents: the International Air Line Employees Association; the Transport Workers Union of America; the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employees; and the International Brotherhood of Teamsters, Chaffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

For a pamphlet describing the duties of reservation, ticket, and passenger agents, write to:

Air Line Employees Association, 5600 S. Central Ave., Chicago, Ill. 60638.

Information about jobs in a particular airline may be obtained by writing to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

MERCHANT MARINE OCCUPATIONS

The American merchant marine is a vital link in the Nation's transportation system. It transports America's products abroad and, in turn, brings imports from the rest of the world. In time of war, it carries troops, arms, and supplies to combat areas. Seafaring employment offers a variety of interesting and rewarding careers as well as travel and adventure.

About 46,500 officers and sailors worked aboard U.S. oceangoing vessels during 1976. The work aboard ships is divided among the deck, engine, and steward departments. The deck department is responsible for navigation, maintenance of the hull and deck equipment, and the supervision of loading, unloading, and stowing of cargo. Personnel in the engine department operate and maintain the machinery that propels the vessel. The steward's department feeds the crew and maintains living and recreation areas.

Due to higher labor and shipbuilding costs the U.S. merchant fleet finds it difficult to compete in the world shipping market. To insure that our country maintains its ability to transport essential cargo, the Government subsidizes the wages paid American crews and in 1970 passed a law to subsidize the construction of 30 new ships annually over a 10-year period. The number of ships built, however, is expected to be only slightly more than the number of older ones taken out of service. Therefore, the size of the U.S. merchant fleet probably will not grow significantly.

Employment of officers is expected to increase slowly through the mid-1980's. Opportunities will be best for graduates of maritime union training programs. Employment of sailors, on the other hand, is expected to decline because new ships are equipped with laborsaving innovations such as automated engine-rooms.

MERCHANT MARINE OFFICERS

Nature of the Work

Every ship has jobs of such importance to its safe operation that the persons doing them are identified as having special responsibilities. These persons are the ships officers.

In command of every oceangoing vessel is the *captain* or *master* (D.O.T. 197.168) who is the shipowner's sole representative. The captain has complete authority and responsibility for the ship's operation and the safety of the crew, passengers, cargo, and vessel.

In addition, while in port, the captain may serve as the shipowner's agent in conferring with custom officials, and in some case may act as paymaster for the ship. Although not technically members of a specific department, captains generally are associated with the deck department, from whose ranks they have been promoted.

Deck Department. Deck officers or "mates," as they are traditionally called, direct movement of the ship and maintenance of the deck and hull. They maintain the authorized speed and course; plot the vessel's position; post lookouts for other ships; record information in the "log" of the voyage; and immediately notify the captain of any unusual occurrences. To comply with coast guard regulations for ensuring the safe and efficient operation of ships, deck officers must be familiar with modern navigational equipment, such as sonar, radar, and radio directional finders.

The *chief mate* (D.O.T. 197.133), also known as the first mate or chief officer, is the captain's key assistant in assigning duties to the deck crew and maintaining order and discipline. The chief mate also plans and supervises the loading and unloading of cargo, and assists the captain in taking the ship in and out of port. On some ships, the chief mate also may be in charge of first-aid treatment.

By tradition, the *second mate* (D.O.T. 197.133) is the navigation officer. The second mate sees that the ship is provided with the necessary navigation charts and that navigation equipment is maintained properly.

Third mates (D.O.T. 197.133), the most junior-rated deck officers act as signal officers and are in charge of all signaling equipment. They also assist in the supervision of cargo loading and unloading. The third mate frequently inspects lifesaving equipment to be sure it is ready for use in fire, shipwreck, or other emergencies.

Engine Department. Marine engineers operate and maintain all engines and machinery aboard ship. The *chief engineer* (D.O.T. 197.130) supervises the engine department, and is responsible for the efficient operation of engines and other mechanical equipment. The chief engineer oversees the operation of the main powerplant and auxiliary equipment while the vessel is underway and keeps records of equipment performance and fuel consumption.

The *first assistant engineer* (D.O.T. 197.130) supervises engineroom personnel and directs operations such as starting, stopping, and controlling the speed of the main engines. The first assistant engineer also oversees and inspects the lubrication of engines, pumps, generators, and other machinery and, with the chief engineer, directs all types of repairs.

The captain has complete authority and responsibility for the ship's operation.

The *second assistant engineer* (D.O.T. 197.130) has charge of the boiler and associated equipment such as the water-feed system and pumps. The second assistant engineer also makes sure proper steam pressure and oil and water temperatures are maintained and supervises the cleaning of boilers.

The *third assistant engineer* (D.O.T. 197.130) supervises the operation and maintenance of the lubrication system and a variety of other engineroom equipment. Some third assistant engineers are responsible for the electrical and refrigeration systems aboard ships.

Other officers. A ship keeps contact with the shore and other vessels through its *radio officer* (D.O.T. 193.282), who also maintains radio equipment. These officers send and receive messages by voice or Morse code. They periodically receive and record time signals, weather reports, position reports, and other information. Radio officers also may maintain depth recording equipment and electronic navigation equipment.

Some freighters and all passenger vessels carry *pursers* (D.O.T. 197.168). The purser or staff officer does the extensive paperwork that is required before a ship enters or leaves a port. They prepare payrolls and assist passengers as required. In recent years, the Staff Officers Association has established a program to train pursers to act also as physician's assistants. This instruction is designed to improve the medical care aboard freighters and tankers and facilitate U.S. Public Health Service clearance when a ship arrives in port. All passenger ships must carry licensed doctors and nurses.

Places of Employment

About 13,300 officers were employed aboard U.S. oceangoing vessels during 1976. Deck officers and engineering officers accounted for more than four-fifths of the total, and radio officers made up most of the remainder. Due to long vacations and other breaks in service such as those resulting from illness there are about two officers employed for every job on a ship.

About two-thirds of the officers were aboard freighters and most of the remainder were aboard tankers. Only a small percentage were on passenger vessels.

Training, Other Qualifications, and Advancement

Applicants for an officer's license in the deck or engineering departments of oceangoing vessels must meet certain legal requirements. Captains, chief and second mates, and chief and first assistant engineers must be at least 21 years old. The minimum age for third mates, third assistant engineers, and radio operators is 19. In addition, applicants must present proof of U.S. citizenship and obtain a U.S. Public Health Service certificate attesting to their vision, color perception, and general physical condition.

Besides legal and medical requirements, candidates must also have at least 3 years of appropriate sea experience or be a graduate of an approved training program. Deck officer candidates must pass Coast Guard examinations that require extensive knowledge of navigation, cargo handling, and deck department operations. Marine engineering officer candidates must demonstrate in-depth knowledge of propulsion systems, electricity, plumbing and steam fitting, metal shaping and assembly, and ship structure. To advance to

higher ratings, officers must pass progressively more difficult examinations.

For a Coast Guard license as a radio officer, applicants must have a first or second-class radiotelegraph operator's license issued by the Federal Communications Commission. For a license to serve as the sole radio operator aboard a cargo vessel, the Coast Guard also requires 6 months of radio experience at sea.

Unlike most professions, no education requirements have been established for officers. A sailor with 3 years' experience in the deck or engine department may apply for either a third mate's license or for a third assistant engineer's license. However, because of the complex machinery, and navigational and electronic equipment on modern ships, formal training usually is needed to pass the Coast Guard's examination for these licenses.

The fastest and surest way to become a well-trained officer is through an established training program. Such programs are available at the U.S. Merchant Marine Academy at Kings Point, N.Y., and at six State merchant marine academies: California Maritime Academy, Vallejo, Calif.; Great Lakes Maritina Academy Traverse City, Michigan; Maine Maritime Academy, Castine, Maine; Massachusetts Maritime Academy, Hyannis, Mass.; Texas Maritime Academy, Galveston, Tex.; and State University of New York Maritime College, Fort Schuyler, New York, N.Y. About 500 students graduate each year from these schools; about one-half are trained as deck officers and one-half as marine engineers. Admission to the U.S. Merchant Marine Academy is through nomination by a member of Congress, whereas entrance to the other academies is made through written application directly to the school.

Most of the academies offer 4-year programs in nautical science or marine engineering, which include courses such as navigation, mathematics, electronics, propulsion systems, electrical engineering, naval architecture, languages, history, and shipping management, as well as practical experience at sea. After Coast Guard examinations are passed, licenses are issued for either third mate or third assistant engineer. In addition, graduates may receive commissions as ensigns in the U.S. Naval Reserve.

Because of their thorough grounding in theory and its practical application, academy graduates are in the best position to move up to master and chief engineer ratings. Their well-rounded education also helps qualify them for shoreside jobs such as marine superintendent, operating manager, design engineers, naval architects, or shipping executive.

The U.S. Merchant Marine Academy now selects about 15 percent of the approximately 250 persons who enter the academy each year to be trained as "omnicompetent" officers. They are taught both navigational and technical skills so they can work in either the deck or engine department. Graduates of the U.S. Merchant Marine Academy have an obligation to serve a minimum of 3 years as officers in the merchant marine or in the military service of the United States.

A number of trade unions in the maritime industry provide officer training. These unions include the International Organization of Masters, Mates and Pilots; the Seafarers' International Union of North America; the Brotherhood of Marine Officers; and the National Marine Engineers' Beneficial Association (MEBA). However due to a crowded job market in recent years, all but the MEBA-operated Calhoon Engineering School in Baltimore, Md., have restricted training programs to upgrading of officers already licensed. The Calhoon School, which produces about 90 graduates every year, offers a third assistant engineer's license. The program consists of both classroom instruction and sea experience and provides free room, board, medical care, and text books in addition to a monthly grant. Trainees must agree to serve at least 3 years in the merchant marine after the 3-year training period.

Advancement for deck and engine officers is along well-defined lines and depends primarily upon specified sea experience, passing a Coast Guard examination, and leadership ability. Deck officers start as third mates. After 1 year's sea service they are eligible to take a second mate examination. A second mate may apply for a chief mate's license after 1 year of sea service. Officers in the engine department start as third assistant engineers. After 1 year of service, they may apply for a second assistant's license and finally a chief engineer's license.

Employment Outlook

Employment of ship's officers is expected to increase more slowly than the average for all occupations through the mid-1980's.

Since World War II, the number of vessels in our merchant marine has declined steadily as the owners of American ships have registered them outside the country. The transfers occurred because ships registered in the United States must employ American crews and, because of their higher wages, cost about twice as much to operate as ships registered abroad and manned with foreign crews. The incentive of obtaining greater profits by lowering operating costs prompted many owners to register their ships outside the U.S.

Little further decline in the number of ships is expected, however, because the Federal Government has taken steps to insure that ships registered in the U.S. and operated by American crews are available to transport essential cargo. To maintain this capability, the Government pays the difference in wages if U.S. crews are used, and helps pay for the construction or purchase of new ships. Some job openings will occur as a result of the need to replace experienced workers who retire, die or take shoreside employment. Replacement needs are relatively high because ships' officers are somewhat older, on the average, than workers in other occupations and the liberal

pension plans offered by the merchant marine industry encourage early retirement. Also, some officers find they prefer the stability of shoreside employment.

Job opportunities are expected to become more favorable in the 1980's than in the near future as the balance between the supply and demand for officers becomes more favorable.

Since maritime unions control a majority of jobs, graduates from union training programs have the best opportunities to obtain jobs aboard ocean-going vessels. However, graduates of merchant marine academies who cannot find jobs on merchant ships generally have little trouble finding jobs in related fields. For example, trained officers are needed on oceanographic research vessels, on vessels that carry supplies to offshore oil drilling rigs, and on dredges operated by the Army Corps of Engineers. Others find jobs with the maritime industry.

Earnings and Working Conditions

Earnings of officers depend upon their rank and the type of ship. Wages are highest on large ships. The accompanying tabulation shows monthly base wages for officers aboard an average freighter in 1976. Additional payments for overtime or for assuming extra responsibilities generally average about 50 percent of base pay. For example, a second mate with a monthly base pay of $1,278 may regularly earn about $1,917 each month.

	Base pay [1]
Captain	$3,717
Chief engineer	3,158
First assistant engineer	1,888
First mate	1,802
Radio officer	1,604
Second assistant engineer	1,338
Second mate	1,278
Third assistant engineer	1,202
Third mate	1,147
Purser	1,055

[1] East Coast wages in June, 1976 aboard a 12,000–17,000 power ton single screw ship.

Officers and their dependents enjoy substantial pension and welfare benefits. Vacations range from 90 to 180 days a year. Officers with 20 years of service have the option of a monthly pension of $325 or 37 1/2 percent of their monthly rate of pay. Those who have 25 years of service are eligible for $425 a month or 50 percent of their monthly rate. Officers forced to retire prematurely due to a permanent disability receive partial pensions. Comprehensive medical care and hospitalization are provided for officers and their families through employer or union programs.

The workweek aboard ship is considerably different from the workweek on shore. At sea, most officers are required to work 7 days a week. Generally, they work two 4-hour watches (shifts) during every 24-hour period and have 8 hours off between each watch. Some officers work 8 hours a day, Monday through Friday. All officers are paid overtime for work over 40 hours a week. When the ship is in port, the basic workweek is 40 hours for all crewmembers.

The duties aboard ship are hazardous compared to other industries. At sea, there is always the possibility of injuries from falls or the danger of fire, collision, or sinking.

Almost 90 percent of all officers belong to maritime unions. The two largest are the International Organization of Masters, Mates and Pilots, representing deck officers, and the National Marine Engineers' Beneficial Association, representing engineering officers. The Brotherhood of Marine Officers represents deck and engine officers on some ships. The Staff Officers Association and the Marine Staff Officers Association represents pursers aboard certain freighters. Radio officers are represented by the American Radio Association and the Radio Officers Union. In addition, a number of independent unions organize officers on tankers. Officers' unions may require initiation fees as high as $4,000.

Sources of Additional Information

For general information about merchant marine officer's jobs, write to:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales, and other particulars is available from local maritime officers' unions. If no maritime union is listed in the local telephone directory, contact:

International Organization of Masters, Mates and Pilots, 39 Broadway, New York, N.Y. 10006.

National Marine Engineers' Beneficial Association, 17 Battery Pl., New York, N.Y. 10004.

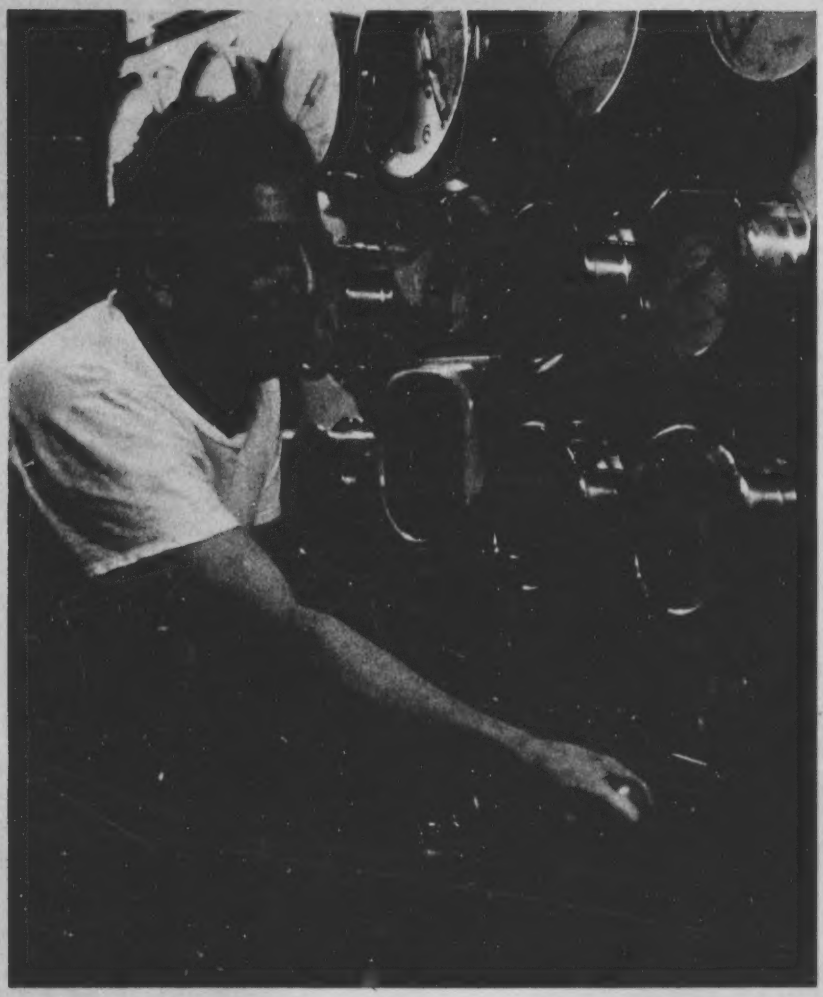
MERCHANT MARINE SAILORS

Nature of the Work

Oil from Saudi Arabia, aluminum ore from Surinam, and cars from Japan, as well as countless other imported commodities, provide much of the energy and raw materials that our economy requires and the finished products that individuals enjoy. Yet these cargoes are so routinely transported across thousands of miles of ocean that our dependence on merchant ships—and sailors—for their delivery in frequently taken for granted.

Sailors make up most of a merchant ship's crew and do most of the manual labor. Employment is along craft lines with varying skill levels. Each worker is assigned to one of the following departments: deck, engine, or steward's.

Deck Department. *Ordinary seamen* (D.O.T. 911.887), the entry rating in the deck department, scrub decks, coil and splice ropes, paint, clean personnel quarters, and do other general maintenance work. They also may relieve able seamen who steer the ship and act as lookouts.



Experience in the Coast Guard or Navy provides a good background for most merchant marine jobs.

Able seamen (D.O.T. 911.884) make up about one-fifth of all sailors. They must have a thorough knowledge of all parts of the ship and be able to handle all gear and deck equipment. They act as quartermasters to steer the ship. Usually, they each take 2-hour turns at the wheel, and also serve as lookouts to watch for other ships.

Able seamen also are responsible for rigging, repairing, and stowing cargo-handling and other gear. They must be able to tie common knots and handle mooring lines when the ship is docking or departing. In addition to their more skilled tasks, they do general deck maintenance work similar to that done by ordinary seamen.

The *boatswain* (D.O.T. 911.131), or bosun, is the highest ranking able seaman. As boss of the deck crew, the boatswain relays the deck officers' orders and sees that these orders are carried out. The boatswain assists the chief mate in assigning work to crewmembers and directs general maintenance operations such as cleaning decks and polishing metalwork. When the ship docks or anchors, the boatswain supervises the deck crew in handling the lines used for mooring.

Some cargo vessels carry one to three *deck utility hands* (D.O.T. 911.884), who maintain the ship's decks under the supervision of the boatswain. They determine the condition of bilges (compartments in the bottom of the hull) and do general maintenance work.

Some vessels carry a *ship's carpenter* (D.O.T. 860.281) who secures cargo hatches and ports, and braces (shores) cargo. The carpenter also may operate winches that hoist and drop the anchor and do other general repair work on the ship's wooden parts.

Engine Department. The engineering staff consists of workers who have a variety of occupational specialties requiring varying degrees of skill from the rating of wiper to specialized skilled jobs such as refrigerator engineer. *Wipers* (D.O.T. 699.887) keep the engineroom and machinery clean. Most cargo vessels carry two or three wipers. *Oilers* (D.O.T. 911.884) lubricate mechanical equipment. They make regular rounds of ship machinery to check oil flow and pressures. Oilers also may help overhaul and repair machinery. *Firers-watertenders* (D.O.T. 951.885) check and regulate the amount of water in the boilers, inspect gauges, and regulate fuel flow to keep steam pressure constant. They also check the operation of evaporators and condensers, which are used to convert salt water to fresh water.

The *ship's electrician* (D.O.T. 825.281) repairs and maintains electrical equipment, such as generators and motors. Electricians also test wiring for short circuits and remove and replace fuses and defective lights.

Certain types of ships require workers who have special skills, such as *refrigeration engineers* (D.O.T. 950.782) who maintain proper temperatures in refrigerator compartments for perishable cargoes such as meat and vegetables.

Steward's Department. The *chief steward* (D.O.T. 350.138) supervises the preparation and serving of meals and the upkeep of living quarters

aboard ship. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. The chief cook also supervises the other galley (ship's kitchen) workers and is responsible for keeping the galley clean and orderly. *Utility hands* (D.O.T. 318.887) and *mess attendants* (D.O.T. 350.878) complete the crew in the steward's department. These beginning jobs require little skill. Utility hands carry food supplies from the storeroom and iceboxes, prepare vegetables, wash cooking utensils, and scour galley equipment. Mess attendants set tables, serve meals, clean tables, wash dishes, and care for living quarters.

Due to the greater use of prepackaged foods and smaller crew sizes, many new ships have reduced the number of workers in the steward's department. For example, the chief cook and chief steward are replaced by a combination chief steward/cook.

Because of the ever-present danger of fire at sea, able seamen must be familiar with fire prevention and control methods. They participate in periodic boat drills and are trained in all operations connected with launching lifeboats and liferafts.

Places of Employment

About 33,200 sailors were employed aboard U.S. oceangoing vessels during 1976. Due to long vacations and other breaks in duty, such as illness, the number of employed sailors is about one and a half times the number of jobs on ships. Nearly two-thirds of the jobs were aboard freighters, and most of the remainder were aboard tankers. Only a small percentage were on passenger ships.

Training, Other Qualifications, and Advancement

Although not required, previous sea experience in the Coast Guard or Navy is a useful background for entering the merchant marine. Applicants must obtain a doctor's certificate specifying they are in excellent health and then must obtain a letter from a shipping company stating that, if qualified, they will be hired if a job becomes available. In addition, applicants must register with the U.S. Coast Guard and acquire from it universal identification papers called a merchant mariner's document. The document, however, does not guarantee a job. It merely qualifies a person to be considered for a job when the supply of regular workers has been exhausted. To get a job, a person must be present at the hiring hall when the opening becomes available.

Hiring halls are located in the chief ports of the country. They are operated by unions for commercial vessels and by the Navy's Military Sealift Command (MSC) for government-operated ships. In most ports along the Atlantic and Gulf Coasts and Great Lakes, the National Maritime Union and the Seafarers' International Union operate hiring halls. The Sailors' Union of the Pacific operates hiring halls in many ports of the West Coast. MSC employment offices are located at Brooklyn, N.Y.; New Orleans, La.; and Oakland, Calif.

Jobseekers are given shipping cards when they register at the hiring hall. The shipping companies send job orders to the hiring hall, and sailors who have been unemployed the longest get first preference on any jobs for which they are qualified. Inexperienced applicants are expected to have difficulty getting jobs because the number of experienced workers already greatly exceeds the number of job openings. Applicants must be present at the hall when jobs are announced and may lose their places if they are not present or have turned down three job offers.

A sailor advances in the deck and engine departments by serving a designated period in a rating, and by successfully completing a Coast Guard examination that tests the ability to use and maintain equipment. For example, after serving a minimum of 1 year, aboard an ocean going vessel an ordinary seaman may apply to the Coast Guard for limited endorsement as an able seaman. For full endorsement, applicants must be at least 19 years of age and pass an examination to test their knowledge of seamanship and ability to carry out all the duties required of able seamen. Able seamen who have supervisory ability may advance to boatswain after years of service.

Most training programs in the industry are designed to help experienced workers upgrade their ratings. However, the Seafarers' International Union of North America operates the Harry Lundeberg School for seamanship at Piney Point, Md. that accepts a limited number of young people who have no sea experience and trains them in general seamanship skills. Upgrading courses for sailors are offered by the Seafarers' Union, the National Maritime Union of America, and a number of other organizations.

Advancement to higher positions in the steward's department is by recommendation of the chief steward to the captain. A mess attendant or utility hand can advance to third cook, to cook-baker, to chief cook, and finally to chief steward.

A small number of persons who show exceptional ability are selected for self-study, union sponsored programs, which enable unlicensed sailors to advance to the licensed ranks as either third mate or third assistant engineer.

Employment Outlook

Employment of merchant sailors is expected to decline through the mid-1980's. Some job openings, however, will arise each year due to the need to replace experienced sailors who retire, die, or quit the sea for other reasons. Competition for these positions is expected to be keen because the number of people seeking jobs as sailors probably will exceed the number of openings. Most openings will be filled by experienced sailors who are unemployed; very few inexperienced applicants are expected to get jobs.

Employment opportunities in the U.S. Merchant Marine are directly related to the number of ships—and to the number of sailors required to operate each ship. After World War

II this country possessed the largest merchant marine fleet ever assembled. Since then, however, the number has declined steadily as some owners transferred their ship's registration outside the country. These transfers occurred because ships registered in the United States must employ American crews and, because of higher wages, cost about twice as much to operate as ships registered abroad and manned with foreign crews. The incentive of obtaining greater profits by lowering operating costs prompted many owners to register their ships outside the U.S.

Little further decline in the number of ships is expected, however, because the Federal Government has taken steps to insure that ships registered in the United States and operated by American crews are available to transport essential cargo. To maintain this capability, the Government pays the difference in wages to a company if they use American crews, and helps pay for the construction or purchase of new ships.

The number of ships is expected to remain about the same because the number of new ships entering service should about equal those being retired. However, employment of sailors is expected to decline because new ships are operated with smaller crews. For example, vessels generally carry a crew of twelve sailors in the engineering department, whereas new ships only carry four: three deck engine mechanics and one wiper. Deck engine mechanics replace oilers, firer-watertenders, and electricians. Older freighters and tankers customarily employ three ordinary seamen, whereas their job has been eliminated on new ships. In addition mechanization of tasks has eliminated jobs for some carpenters and the use of prepackaged food and smaller crew sizes have reduced the number of cooks and stewards.

Employment opportunities may improve if the Government mandates that a fixed proportion of imported oil or exported grains is to be carried in American ships—a move that would require more American ships.

Earnings and Working Conditions

Crewmembers of American merchant ships enjoy excellent pay and fringe benefits. Earnings depend on job assignments and type of vessel. Basic monthly pay for a cross section of ratings on a typical freighter in 1976 is shown in the accompanying tabulation:

	Base pay [1]
Electrician	$1,117
Chief steward	950
Carpenter	874
Cook/Baker	822
Deck utility hand	807
Able seaman	723
Firer-watertender	723
Oiler	723
Ordinary seaman	564
Mess attendant/utility hand	560

[1] East Coast wages in June, 1976 aboard a 12,000–17,000 power ton single screw ship.

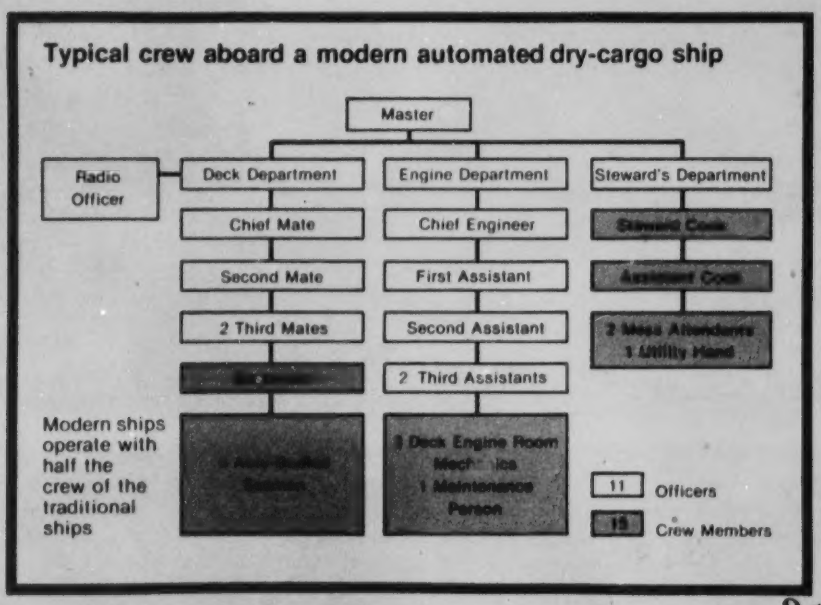
Monthly wages are supplemented by premium pay for overtime and other factors. On the average, premium earnings are equal to about 50 percent of base wages. For example, an oiler with a monthly base pay of $723 regularly earns about $1,084 each month.

Liberal employer-financed fringe benefits are provided. Vacations range from 90 to 180 days a year. Sailors may retire on pensions after 20 years of service. Sailors and their dependents are covered by comprehensive medical care and hospitalization programs.

The workweek aboard ship is considerably different from the workweek on shore. At sea, most sailors are required to work 7 days a week. Generally, they work two 4-hour watches (shifts) during every 24-hour period and have 8 hours off between each watch. Some sailors are day workers. They work 8 hours a day, Monday through Friday. All sailors are paid overtime for work over 40 hours a week. When the ship is in port, the basic workweek is 40 hours for all crewmembers.

A person working in the engineroom must be able to withstand high temperatures while a deck worker must adapt to both bitter cold and the hot sun. At sea, there is always the possibility of injuries from falls or the danger of fire, collision, or sinking.

Accommodations for sailors aboard U.S. vessels are generally good, but not luxurious. Meals are served in a messroom, which often doubles as a recreation room where the crew can read, write letters, play cards, and socialize. Crewmembers



generally share quarters aboard older ships and have little privacy, but most new ships have single-berth rooms. Many sailors find the work aboard ship routine and boring.

Sailors are represented by a number of labor organizations; the two largest are the National Maritime Union of America and the Seafarers' International Union of North America.

Sources of Additional Information

For general information about merchant marine sailors' jobs, write to:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings, qualifications for employment, wage scales, and other particulars is available from local maritime unions. If no maritime union is listed in the local telephone directory, contact:

National Maritime Union of America, 36 Seventh Ave., New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Ave., Brooklyn, N.Y. 11232.

RAILROAD OCCUPATIONS

People, food, and industrial materials all move along the 200,000 miles of railroad lines that crisscross the Nation. In 1976, the railroads provided jobs for about 531,000 people. Railroad jobs are found in all States except Hawaii, and in communities of all sizes.

Large numbers of railroad workers are employed at terminal points where the railroads maintain control offices, freight yards, and maintenance and repair shops. Chicago, the hub of the Nation's railroad system, has more railroad workers than any other area, but many also are employed in or near New York, Los Angeles, Philadelphia, Minneapolis, Pittsburgh, and Detroit.

Railroad workers can be divided into four main groups: Operating employees; station and office workers; equipment maintenance workers; and property maintenance workers.

Operating employees make up almost one-third of all railroad workers. This group includes locomotive engineers, conductors, and brake operators. Whether on the road or at terminals and railroad yards, they work together as traincrews. Some other employees in this group are hostlers, who prepare locomotives for the traincrews, and switchtenders, who throw track switches within railroad yards.

One-fourth of all railroad workers are *station and office employees*, who direct train movements and handle the railroads' business affairs. Professionals such as managers, accountants, statisticians, and systems analysts do administrative and planning work, while clerks handle business transactions, keep records, and prepare statistics. Agents manage the business affairs of the railroad stations. Telegraphers and telephoners pass on instructions to traincrews and help agents with clerical work.

More than one-fifth of all railroad employees are *equipment maintenance workers*, who service and repair locomotives and cars. This group includes car repairers, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

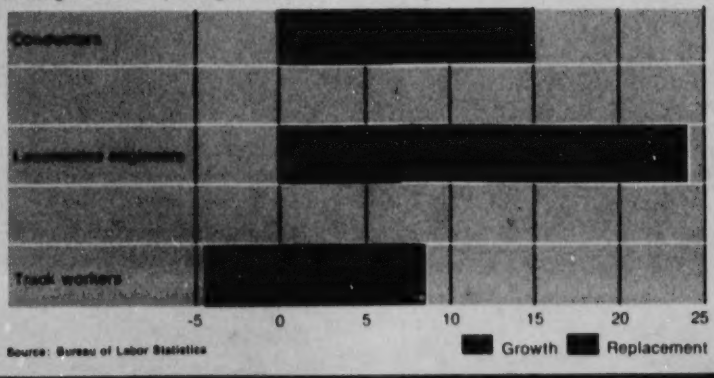
Property maintenance workers, who make up about one-sixth of all railroad employees, build and repair tracks, tunnels, signal equipment, and other railroad property. Trackworkers repair tracks and roadbeds. Bridge and building workers construct and repair bridges, tunnels, and other structures along the right-of-way. Signal workers install and service the railroads' vast network of signals, including highway-crossing protection devices.

Discussions of the work, training, outlook, and earnings for some major occupations in railroads are presented in the statements that follow. Information on employment also is available in the statement on occupations in the railroad industry elsewhere in the *Handbook*. Details about specific jobs may be obtained from local railroad offices. General information on the industry is available from:

Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C. 20036.

Technological innovations will restrain growth of railroad occupations; limited openings will result from replacement needs

Selected railroad occupations
Average annual openings, 1976-85 (in hundreds)



Source: Bureau of Labor Statistics

BRAKE OPERATORS

(D.O.T. 910.364 and .884)

Nature of the Work

Brake operators play a pivotal role in making locomotives and cars into trains. Working with engineers and under the direction of conductors, they do the physical work involved in adding and removing cars at railroad stations and assembling and disassembling trains in railroad yards.

All passenger and most freight traincrews include two road brake operators—one in the locomotive with the engineer and another in the caboose with the conductor. A few small freight trains need only one in the locomotive. Before departure, road brake operators inspect the train to make sure that all couplers

and airhoses are fastened, that handbrakes on all the cars are released, and that the airbrakes are functioning correctly. While underway they regularly look for smoke, sparks, and other signs of sticking brakes, overheated axle bearings, and other faulty equipment. They may make minor repairs to airhoses and couplers. In case of unexpected stops, brake operators set out signals to protect both ends of the train.

Yard brake operators help assemble and disassemble trains in railroad yards.

When freight trains approach an industrial site, the brake operator in the locomotive jumps off the moving train and runs ahead to switch the train to the proper track. The brake operators uncouple cars that are to be delivered and couple those that are to be picked up.

On passenger trains, brake operators regulate car lighting and temperature, and help the conductor collect tickets and assist passengers.

Yard brake operators (also known as yard couplers or helpers) help assemble and disassemble trains in railroad yards, according to instructions from yard conductors. They use hand signals or two-way radios to signal engineers where to move cars. Railroad cars generally are not pushed very far by the engine, but instead are allowed to roll to their destination in the yard. Brake operators uncouple the cars and throw track switches to route them to certain tracks if they are to be unloaded, or to an outgoing train if their final destination is further down the line. They may ride a car, operating the handbrake to regulate its speed.

Training, Other Qualifications, and Advancement

On most railroads, beginning brake operators make several trips with conductors and experienced operators to become familiar with the job. Their names are then put on the "extra board" and they are given assignments to substitute for workers who are absent for vacations, illness, or other reasons. On some railroads, however, new brake operators first are given several days of training, including instruction on signaling, coupling and uncoupling cars, throwing switches, and boarding moving equipment. Following this training period, these brake operators accompany experienced crews for several trips before being placed on the "extra board." It usually takes several years before brake operators acquire enough seniority to get regular assignments.

Employers prefer applicants who are high school graduates or the equivalent. Good eyesight and hearing are essential. Mechanical apti-

tude is helpful. Physical stamina is necessary to board moving trains, throw switches, and operate handbrakes. Most employers require that applicants pass physical examinations.

With sufficient seniority, brake operators may become conductors. These jobs are always filled by promoting experienced brake operators who have qualified by passing written and oral tests on signals, brake systems, timetables, operating rules, and other subjects. Some companies require that these tests be passed within the first few years of the brake operator's employment. Since promotions on almost all railroads are controlled by seniority rules, brake operators usually wait at least 10 years before becoming conductors. Advancement is limited by the number of conductor jobs, and there are many more brake operators than conductors. A few brake operators in freight service move to passenger service, usually considered more desirable because it is less strenuous.

Employment Outlook

Employment of brake operators—who numbered nearly 65,000 in 1976—is not expected to change through the mid-1980's. Employment is expected to increase in the short run, however, as an improving economy leads to more freight traffic. Although many of the available openings will be taken by experienced brake operators now on furlough, some jobs will be available for new workers. Openings also will develop as experienced brake operators retire, die, advance to jobs as conductors, or transfer to other work.

Even though total employment of brake operators is not expected to change in the long run, the number of those in road service will increase since more trains will be needed to haul the additional freight volume created by growth in population and industry. Employment gains will be moderated, however, by innovations that make it possible to move freight more efficiently. For example, trains will be able to carry more freight as the railroads continue to replace older freight cars with larger, better designed ones.

The number of yard brake operators is expected to decrease, primarily due to the installation of automatic classification systems in more yards. In an automatic classification yard, cars are braked and routed by electronic controls. Fewer brake operators are needed in these yards, mainly to connect airhoses, uncouple cars, and retrieve misrouted ones. Yard employment also will be affected by the new freight cars, which take as much time to route as older ones but carry more freight.

Earnings and Working Conditions

In 1976, brake operators had average monthly earnings of $1,206 in yard service, $1,523 in freight service, and $1,637 in passenger service. These earnings were about twice as much as the average for all nonsupervisory workers in private industry, except farming.

Yard brake operators usually work a scheduled 40-hour week and receive premium pay for overtime. Road brake operators are paid according to miles traveled or hours worked, whichever is greater. Brake operators often work nights, weekends, and holidays.

Most freight trains are unscheduled so few road brake operators have scheduled assignments. Instead, their names are placed on a list and when their turn comes they are assigned the next train, usually on short notice and often at odd hours. Since freight and passenger brake operators often work on trains that operate between terminals that are hundreds of miles apart, they may spend several nights a week away from home. Brake operators assigned to extra board work have less steady work, more irregular hours, and lower earnings than those with regular jobs.

Most brake operators are members of the United Transportation Union.

CONDUCTORS

(D.O.T. 198.168)

Nature of the Work

Conductors are in charge of train and yard crews. They are responsible for the safe and punctual delivery of cargo and passengers and the accurate assembly of trains.

Before a train leaves the terminal, the conductor receives instructions on the train's route, timetable, and cargo from the dispatcher, and discusses these with the engineer. On many trains conductors can receive additional information by radio while underway. This may include information about track conditions ahead, or instructions to pull off at the next siding to let another train pass.

During runs, conductors use two-way radios to contact engineers. They pass on instructions received from dispatchers and remind engineers of stops, reported track conditions, and the presence of other trains. Conductors regularly receive information from brake operators on the condition of the cars. If a problem occurs, conductors arrange either for repairs while underway or for removal of the defective car at the nearest station or siding. They inform dispatchers of this development using radio or wayside telephones.

On freight trains, the conductor keeps records of each car's contents and destination, and sees that cars are added and removed at the proper points along the route. On a passenger train, conductors collect tickets and fares, and answer passengers' questions concerning timetables and train rules. At stops they signal engineers when to leave.

Yard conductors supervise the crews that assemble and disassemble trains. They receive instructions from yardmasters concerning where to move the cars of newly arrived trains. Some cars will be sent to special tracks for unloading, while the rest will be moved to other tracks to be made into trains going to different cities. Conductors tell engineers where to move cars while brake operators are told which cars to couple and uncouple and which switches to throw to divert the locomotive or cars to the proper track. In yards that have automatic classification systems, conductors may use electrical controls to operate the track switches that route cars to the correct track.

Conductors receive instructions by radio while underway.

Training, Other Qualifications, and Advancement

Jobs as conductors always are filled from the ranks of experienced brake operators who have passed tests covering signals, timetables, operating rules, and related subjects. Until permanent positions become available, new conductors are put on the "extra board," where they substitute for experienced conductors who are absent because of illness, vacations, or other reasons. On most railroads, conductors on the extra board may work as brake operators if there are not enough conductor runs available for them that month. Seniority almost always is the main factor in determining promotion from brake operator to conductor and from the extra board to a permanent position.

Most railroads maintain separate seniority lists for road service and yard service conductors; conductors usually remain in one type of service for their entire careers. On some roads, however, conductors start in the yards, then move to freight service, and finally to passenger service. Some conductors advance to managerial positions such as trainmaster or yardmaster.

Employment Outlook

Employment of conductors—who numbered about 35,900 in 1976—is expected to grow more slowly than the average for all occupations Most job openings will result from the need to replace conductors who are promoted, or who retire or die.

The transportation requirements of the country will increase as growth in population and industry creates a demand for more consumer and industrial products. This will result in an increase in employment of road service conductors, since more trains will be needed to haul the additional freight volume. However, employment growth will be moderated by innovations that make it possible to move freight more efficiently. For example, trains will be able to carry more freight as the railroads continue to replace older freight cars with larger, better designed ones.

Employment of yard conductors, on the other hand, is not expected to change. Continued modernization of yards, especially the addition of automatic classification systems, will improve yard efficiency. Yard employment also will be affected by the new freight cars which take as much time to route as older ones but carry more freight.

Earnings and Working Conditions

In 1976, conductors had average monthly earnings of $1,489 in yard service, $1,626 in passenger road service, and $1,829 in freight road service. These earnings were more than double the average for all nonsupervisory workers in private industry, except farming.

Yard conductors usually work a scheduled 40-hour week and receive premium pay for overtime. Road conductors are paid according to miles traveled or hours worked, whichever is greater. Conductors often work nights, weekends, and holidays.

Most freight trains are unscheduled so few road conductors have scheduled assignments. Instead, their names are placed on a list and when their turn comes they are assigned the next train, usually on short notice and often at odd hours. Since road service conductors often work on trains that operate between stations that are hundreds of miles apart, they may spend several nights a week away from home. Conductors on the extra board frequently work less than 40 hours a week as conductors and, therefore, earn less than those who have regular jobs.

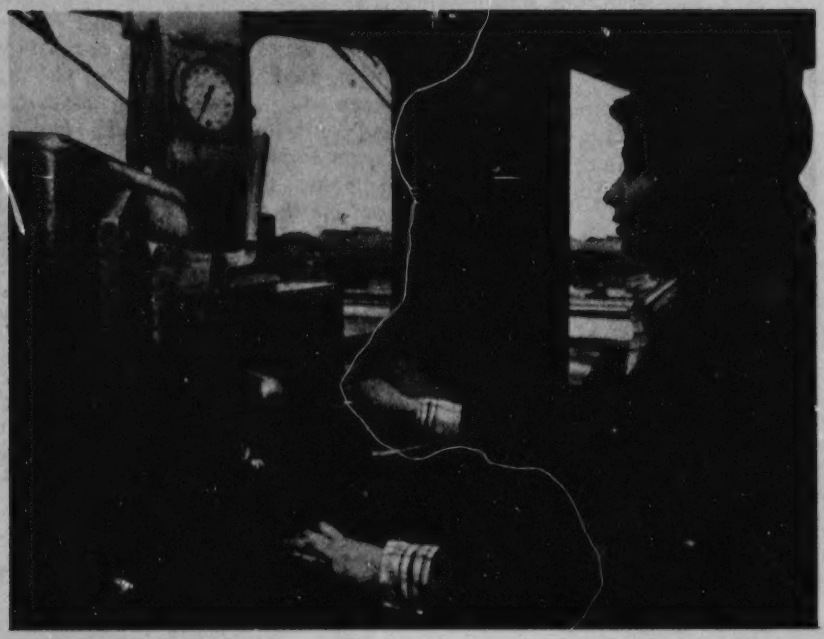
Many conductors are members of the United Transportation Union.

LOCOMOTIVE ENGINEERS

(D.O.T. 910.383)

Nature of the Work

Engineers are among the most skilled employees on the railroad.



Engineers watch for signals that indicate track obstructions and the need to lower speed.

They must have a thorough knowledge of the signal systems, yards, and terminals along their route and be constantly aware of the condition and makeup of the train. Trains react differently to acceleration, braking, and curves, depending on the number of cars, the ratio of empty to loaded cars, or the amount of slack in the train. Misjudgment by the engineer of these or many other factors can lead to whiplash injuries to passengers and crew members, damaged cargo, broken couplers, or even derailment.

Engineers operate locomotives in passenger, freight, and yard services. Road service engineers transport cargo and passengers between stations, while yard engineers move cars within yards to assemble or disassemble trains. Most engineers run diesel locomotives; a few run electrics.

Engineers operate the throttle to start and accelerate the train and use airbrakes to slow and stop it. They also watch gauges and meters that measure speed, fuel, battery charge, and air pressure in the brake lines. Both on the road and in the yard, they watch for signals that indicate track obstructions and speed limits.

Before and after each run, engineers check locomotives for mechanical problems. Minor adjustments are made on the spot, but major defects are reported to the engine shop supervisor.

Training, Other Qualifications, and Advancement

Openings in engineer jobs on the majority of railroads are filled by training and promoting engineer helpers according to seniority rules. Some railroads, though, train applicants directly as engineers. A few train brake operators.

Helpers ride in locomotives with engineers and assist them by inspecting locomotives, watching for signals and track obstructions, and monitoring gauges. New helpers receive on-the-job training lasting up to 6 weeks during which time they learn their duties and railroad rules and regulations. They are then assigned as engineer helpers on regular jobs.

Railroads prefer that applicants for helper and engineer positions have a high school education and be at least 21 years old. Applicants must have good hearing, eyesight, and color vision. Good eye-hand coordination, manual dexterity, and mechanical aptitude also are required.

Helpers are placed in training programs for engineer jobs within 1 year following their initial hiring date. These programs, and those for engineer trainees and brake operators, include classroom and on-the-job training in locomotive operation. Many programs include extensive training on simulators. At the end of the training period, the potential engineers take qualifying tests covering locomotive equipment, airbrake systems, fuel economy, train handling techniques, and operating rules and regulations.

As engineers are needed, newly trained engineers or qualified helpers who have the longest seniority are placed on the engineers' "extra board." Extra board engineers who do not have regular assignments substitute for regular engineers who are absent because of vacation, illness, or other reasons. Extra board engineers frequently have to wait a number of years before accumulating enough seniority to get a regular assignment. Seniority rules also may determine the engineers' type of service; for instance, from a first regular assignment in yard service, they may move to road service.

Engineers take periodic physical examinations to determine fitness to operate locomotives. They must have keen eyesight and hearing. Those who fail to meet the physical standards are restricted to yard service.

Employment Outlook

Employment of locomotive engineers—who numbered about 33,300 in 1976—is expected to increase more slowly than the average for all occupations through the mid-1980's. Most job openings will arise from the need to replace engineers who retire or die.

The need for transportation services will increase as growth in population and industry creates a demand for more consumer and industrial products. This will result in an increase in employment of road service engineers, since more trains will be needed to haul the additional freight volume. However, this employment

growth will be moderated by innovations that make it possible to move freight more efficiently. For example, trains will be able to carry more freight as the railroads continue to replace older freight cars with larger, better designed ones.

Employment of yard engineers, on the other hand, is not expected to change. Continued modernization of yards, especially the addition of automatic classification systems that electronically route cars to the proper track, will improve yard efficiency. Yard employment also will be affected by the new freight cars, which take as much time to route as older ones but carry more freight.

Earnings and Working Conditions

The earnings of engineers depend on the size of the locomotive and type of service. In 1976, monthly earnings of engineers averaged $1,634 in yard service, $2,008 in passenger service, and $2,080 in freight service. Engineers earned two to three times as much as the average for all nonsupervisory workers in private industry, except farming.

Yard engineers work 5 days or more a week, depending on the railroad. Their hours are scheduled and they receive premium pay for working more than 8 hours in any day. Road service engineers are paid by miles traveled or hours worked, whichever is greater. Many railroads place a maximum on the number of miles a road service engineer can cover per month. Those who reach the limit are replaced by extra board engineers for the rest of the month. Engineers often work nights, weekends, and holidays at regular pay.

Most freight trains are unscheduled so few road engineers have scheduled assignments. Instead, their names are placed on a list and when their turn comes they are assigned the next train, usually on short notice and often at odd hours. Since those in road service may deliver cargo or passengers to a distant station one day and not return until the next, they may spend several days a week away from home. Engineers assigned to the extra board have less steady work, more irregular hours, and lower earnings than those with regular jobs.

Most engineers are members of the Brotherhood of Locomotive Engineers; some are members of the United Transportation Union.

SHOP TRADES

Nature of the Work

Every railroad employs its own workers to maintain, repair, and rebuild railroad cars, locomotives, and other equipment. In 1976, there were over 72,600 workers in the six principal shop trades—about 38,300 car repairers, 16,300 machinists, 10,900 electrical workers, 4,500 sheet-metal workers, 1,400 boilermakers, and 1,100 blacksmiths. These skilled craft workers are employed in railroad yards, terminals, and engine houses, as well as in major car and locomotive repair facilities.

Car repairers (D.O.T. 622.381) keep freight and passenger cars, tank cars, and some sections of locomotives in good running condition. Some repairers specialize in visually examining cars and locomotives every time they enter yards. They inspect parts such as wheels, brake assemblies, and couplers, looking for defects that might lead to accidents or delays. They may make minor repairs on the spot, but defective cars usually are fixed on special tracks by other car repairers. These repairs include straightening ladders on freight cars, fixing leaks in car roofs, changing wheels, and replacing couplers.

Some car repairers work in special yards rebuilding old or badly damaged cars. They also may convert standard cars received from manufacturers into custom-built ones for specialized purposes.

The other shop workers are involved primarily with servicing locomotives. Locomotives are overhauled on a regular basis and each craft plays a role in the inspection and repair of defective or damaged locomotives.

Although a few machinists use metal cutting and forming tools to repair parts of locomotives, most do mechanical work on engines. During overhauls, *machinists* (D.O.T.

Some repairers rebuild old or badly damaged cars or convert standard cars into custom-built ones for specialized purposes.

600.280) examine valves, transmissions, fuel lines, and other components for damage or wear. During major overhauls they may strip the engine completely. Exterior components, such as wheels and axles, also are inspected and any defective or worn parts are replaced.

During these overhauls, *electrical workers* (D.O.T. 721.381) repair or install new wiring and inspect the generator and electric motors in the engine. They also maintain air-conditioning systems and the cooling systems in refrigeration cars. Some maintain the wiring in railroad buildings.

Machinists and electrical workers also examine engines that have mechanical or electrical problems. Much of this work is done in the shop, but if a locomotive breaks down up the track, a team consisting of a skilled machinist and an electrical worker is sent to the site to attempt to repair it on the spot.

Sheet-metal workers (D.O.T. 804.281) and *boilermakers* (D.O.T. 805.281) repair sheet-metal sections of locomotives and the pipes and tubes in locomotive engines. They also work on other equipment made of steel plates such as stationary boilers and tanks. *Blacksmiths* (D.O.T. 610.381) repair locomotive frames and other heavy metal parts. More information on machinists, electricians, boilermakers, and blacksmiths can be found elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Although apprenticeship training is the most common way to enter shop trades, some helpers and laborers are upgraded to these jobs. Apprenticeships last 3 to 4 years, depending on how much previous work experience the apprentice has.

Most apprentices are between 18 and 21 years of age, although some are older at the start of their training. On some roads, apprentice applicants must pass mathematical and mechanical aptitude tests.

Applicants who have had shop training in high schools or vocational schools are preferred by most railroads. Automobile repair and machining courses are useful for machinists. Courses in electricity and physics will help applicants who want jobs as electrical workers.

Some workers in the shop trades advance to supervisory positions.

Employment Outlook

Employment of shop trades workers is expected to decline through the mid-1980's as shop efficiency continues to increase and as older railroad cars are replaced with new ones that are more durable and more easily maintained. However, job openings will develop for new apprentices or helpers as experienced workers retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1976, hourly earnings averaged $7.00 for electrical workers, $6.98 for boilermakers, $6.94 for machinists, $6.87 for blacksmiths, $6.90 for car repairers, and $6.96 for sheet-metal workers. Most shopworkers have a 40-hour workweek and receive premium pay for overtime.

Shopwork is active and strenuous, involving stooping, climbing, and lifting. In addition, much of the work of car repairers is done outdoors in all kinds of weather. Other workers face noisy shop conditions.

Most shopworkers are union members. Among the unions in this field are: Brotherhood of Railway Carmen of the United States and Canada; International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; International Brotherhood of Boilermakers, Iron Shipbuilders, Blacksmiths, Forgers and Helpers; Transport Workers Union of America; and the International Brotherhood of Firemen and Oilers. Several of these unions negotiate labor-management agreements through the Railway Employes' Department of the AFL-CIO.

SIGNAL DEPARTMENT WORKERS

(D.O.T. 822.281 and .884)

Nature of the Work

Railroad signal workers install, repair, and maintain the train control, communication, and signaling systems that direct train movement and assure safety. These include gate crossings and signal lights, as well as systems that operate signals and throw switches by remote control. The work usually consists of either general maintenance of the signal systems or installation and major repair.

Signal installers work in crews, usually consisting of at least five workers. They install new equipment and make major repairs. They do mostly construction work that includes digging holes and ditches, hoisting poles, and mixing and pouring concrete to make foundations. They also assemble the control and communications devices, make the electrical connections, and perform the extensive testing that is required to assure that new signal systems work properly.

Individual *signal maintainers* are assigned a section of track and are responsible for keeping gate crossings, signals, and other control devices within their section in good operating condition. They periodically inspect and repair or replace wires, lights, and switches. They may have to climb poles to reach signals and sometimes work near high voltage wires. Signal maintainers and installers must have a thorough knowledge of electricity and electronics.

Training, Other Qualifications, and Advancement

New employees usually are assigned as helpers to installation crews. After a 60- to 90-day probationary period, helpers are eligible to advance to assistants. Some railroads hire applicants directly as assistants. After 2 to 4 years, which may include classroom instruction, qualified assistants are promoted to signal installer or maintainer. Assistants usually ad-

Signal maintainer carefully checks lights.

vance to signal installer, though, since openings in the more desirable maintenance positions usually are filled by senior signal installers. These promotions and assignments are made on the basis of seniority, provided ability is sufficient.

When hiring helpers or assistants, railroads prefer applicants who are high school or vocational school graduates. Courses in blueprint reading, electricity, and electronics provide a helpful background. Applicants also should be capable of doing heavy work.

Both signal installers and maintainers may be promoted to signal inspector or technician. Technicians assist installers with complicated systems while inspectors check the work of both installers and maintainers. Some installers and maintainers become gang supervisors and a few advance to higher supervisory positions.

Employment Outlook

Employment of signal department workers—who numbered about 11,500 in 1976—is not expected to change significantly through the mid-1980's. Nevertheless, some job openings for new workers will arise as experienced workers retire, die, or transfer to other fields.

Signal workers will continue to be needed to repair the existing stock of equipment as well as install and maintain the new signal and train control systems that are planned for the future. Employment is not expected to grow, however, since many new signal systems, which have fewer moving parts, require less maintenance. Employment also will be affected as the railroads continue to close some sections of track that are unprofitable or are made unnecessary as the installation of improved train control systems enables railroads to use less track.

Earnings and Working Conditions

In 1976, signal installers and maintainers averaged $6.77 an hour, about two-fifths more than the average for all nonsupervisory workers in private industry, except farming. Assistants averaged $5.85 an hour and helpers $5.74 an hour. Most signal workers have a 40-hour week and receive premium pay for overtime.

Since they work over large sections of track, installers usually live away from home during the workweek, frequently in camp cars provided by the company. Maintainers usually live at home and service signals over a limited stretch of track. However, they must make repairs regardless of weather conditions or time of day.

Most signal installers and maintainers are members of the Brotherhood of Railroad Signalmen.

STATION AGENTS

(D.O.T. 211.468. and 910.138)

Nature of the Work

Station agents are the customers' contact with the railroad. Most agents work in small freight stations. They take orders from companies that need cargo shipped and arrange for railroad cars to transport their product. When loaded cars are delivered to a station, the agent inspects the merchandise for damage and informs the recipient that the goods are ready for unloading. Agents prepare customer bills and must be knowledgeable about the complex railroad billing procedure. Agents also may pass on train orders and other messages to train crews. At larger stations, many of these tasks may be done by clerks, telephoners, and others who are under the agent's supervision.

At passenger stations, agents supervise and coordinate the activities of workers who sell tickets and check baggage. At major freight and passenger stations, the agent's duties are primarily administrative and supervisory.

Some agents, sometimes called mobile agents, service several small stations that get little business. They travel from station to station, opening each only long enough to transact the business at hand.

Training, Other Qualifications, and Advancement

Station agents rise from the ranks of other railroad occupations. With sufficient seniority and ability, telephoners, telegraphers, tower operators, and clerks may be promoted to agents in small stations and may advance to larger stations as they gain additional seniority. Agents also may be promoted to managerial positions such as supervisory agent or auditor.

Employment Outlook

Employment of station agents—who numbered about 7,000 in 1976—is expected to decline through the mid-1980's as more customer orders and billing are handled at large, centrally located stations, and as an increasing number of smaller stations are serviced by mobile agents. Nevertheless, a limited number of jobs will arise from the need to replace experienced agents who retire, die, or stop working for other reasons.

Earnings and Working Conditions

The earnings of station agents vary. In 1976, agents in small stations averaged $6.75 an hour, while agents in major stations averaged $8.21 an hour. A 40-hour workweek is standard, and time and one-half is paid for overtime.

Station agents are members of the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees.

TELEGRAPHERS, TELEPHONERS, AND TOWER OPERATORS

(D.O.T. 236.588 and 910.782)

Nature of the Work

The movements of trains on many sections of track are directed from central locations. Switches are thrown by remote control and crews are contacted by radio. Where this centralized control has not been put into effect, however, trains are controlled by telegraphers, telephoners, and tower operators.

Tower operators work in towers located in railroad yards or at major junctions on the outskirts of cities. Following instructions given by dispatchers and yardmasters, they route train traffic by operating controls that activate signals and throw switches on the track below. By throwing switches, a tower operator in a yard can route trains to other yards within the city, onto industrial tracks to pick up or deliver cars, or to a main track leaving the city. Once a train is outside the city, a tower operator directs it from the main track to tracks leading to other cities. By controlling signals, tower operators also can pass on instructions to train crews. For example, if a yard is full, the yardmaster will instruct a tower operator to signal an approaching train to wait outside the city, rather than have it block streets while waiting its turn at the entrance to the yard.

Telegraphers and telephoners work in yards and stations. They receive orders on train movement from dispatchers and pass this information on to train crews, either verbally or in written instructions. These orders may include information on a train's route or directives to maintain lower speed limits because of poor track conditions. Those at stations assist station agents in taking orders and billing customers.

Training, Other Qualifications, and Advancement

Jobs as telegraphers, telephoners, and tower operators are filled from the ranks of clerical workers according to seniority provisions. It takes several years for a newly hired clerk to acquire sufficient seniority to advance to one of these positions.

New telegraphers, telephoners, and tower operators receive on-the-job training that covers operating rules, train orders, and station operations. On most roads, trainees must pass examinations on train operating rules and demonstrate their ability to use the equipment before they can qualify. Newly qualified workers usually are assigned to the "extra board" to work as substitutes for telegraphers, telephoners, and tower operators who are absent due to vacations, illness, or other reasons. After gaining enough seniority, they generally can bid for regular assignments.

Telegraphers, telephoners, and tower operators should be responsible and alert. In addition, tower operators should be capable of organizing thoughts and actions in emergency or pressure situations. Good hearing and eyesight, including normal color vision, are required.

A few telegraphers, telephoners, and tower operators advance to positions as station agent or train dispatcher.

Employment Outlook

Employment of telegraphers, telephoners, and tower operators—who numbered about 10,200 in 1976—is expected to decline through the mid-1980's. Nevertheless, a small number of clerks will be promoted to replace experienced workers who retire, die, or change occupations.

Employment in these fields will continue to decline as technological developments increase worker productivity through the wider use of mechanized yard operations, centralized traffic control, and other automatic signaling and control systems.

Earnings and Working Conditions

In 1976, hourly earnings for telegraphers, telephoners, and tower operators averaged $6.57, about one-third more than the average for all nonsupervisory workers in private industry, except farming. A 40-hour week is standard, and time and one-half is paid for overtime.

Most telegraphers, telephoners, and tower operators are members of the Brotherhood of Railway, Airline and Steamship Clerks, Freight Handlers, Express and Station Employees.

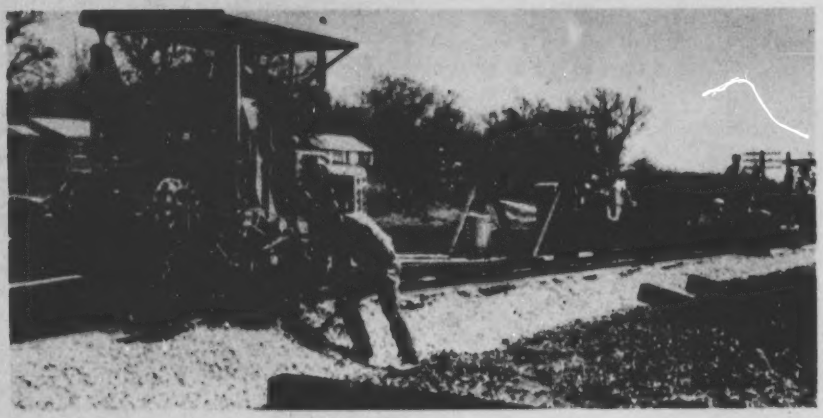
TRACK WORKERS

(D.O.T. 182.168, 859.883, 869.887, and 910.782)

Nature of the Work

A major factor limiting train speed is the quality of the track. Many locomotives are capable of pulling hundreds of cars at speeds as fast as 75 miles an hour, but train speed must drop sharply on poorly maintained track to avoid accidents. Preventing track deterioration and the accompanying loss in railroad efficiency is the job of track workers, who service, repair, and replace railroad track and roadway.

Most track workers are members of large, heavily mechanized traveling crews which do scheduled preventive maintenance and major repair work over hundreds of miles of track. Many of these workers operate heavy machinery, such as bulldozers, cranes, and machines which they use to lay rail, replace ties, or clean ballast. Others use power tools to drive and pull spikes, cut rails, and tighten



Track workers laying rail.

bolts. Handtools, such as picks and shovels, are used less frequently.

Section crews, which are smaller and less mechanized than the traveling ones, do less extensive repairs. They are assigned a smaller section of track to keep in condition between the major overhauls of the traveling crews. Section workers regularly inspect the track and roadway, and repair or replace malfunctioning switches, weak ties, cracked rails, washouts, and other defects.

Training, Other Qualifications, and Advancement

Most track workers learn their skills through on-the-job training that lasts about 2 years. Machine-operating jobs are assigned to qualified workers by seniority.

Railroads prefer applicants who can read, write, and do heavy work. Applicants may be required to pass physical examinations.

Some track workers who have the necessary seniority and other qualifications may advance to gang or section supervisor, then to positions such as track supervisor.

Employment Outlook

Employment of track workers—who numbered about 56,200 in 1976—is not expected to change through the mid-1980's. But employment is expected to increase in the short run as funds for track renovation become available through government action.

Railroads are expected to upgrade much of the right-of-way in an effort to increase efficiency, and the speed and extent of this renovation will determine the need for additional workers. Over the long run, however, increased productivity of track workers—as machines do more of the work—will moderate employment needs. In addition, railroads will continue to close some sections of track that are unprofitable or are made unnecessary as the installation of improved train control systems enables railroads to use less track. Despite this lack of growth, new track workers will be needed each year to replace experienced workers who retire, die, or transfer to other occupations. Most job openings will be in traveling crews.

Earnings and Working Conditions

In 1976, track workers averaged $5.89 an hour, slightly more than the average for all nonsupervisory workers in private industry, except farming. Equipment operators and helpers averaged $6.16 and crew supervisors averaged $6.54 an hour. A 40-hour workweek is standard, and premium rates are paid for overtime. Some track workers, especially those working on traveling crews on the northern railroads, are furloughed during the winter months.

Track workers on traveling crews may have to commute long distances to reach the worksite. Many, however, live in camp cars or trailers provided by the railroads. Workers on section crews sometimes have to perform emergency repairs at night during bad weather conditions. Track workers have strenuous and active jobs. The tools they use are fairly heavy and they often work in bent and stooped positions.

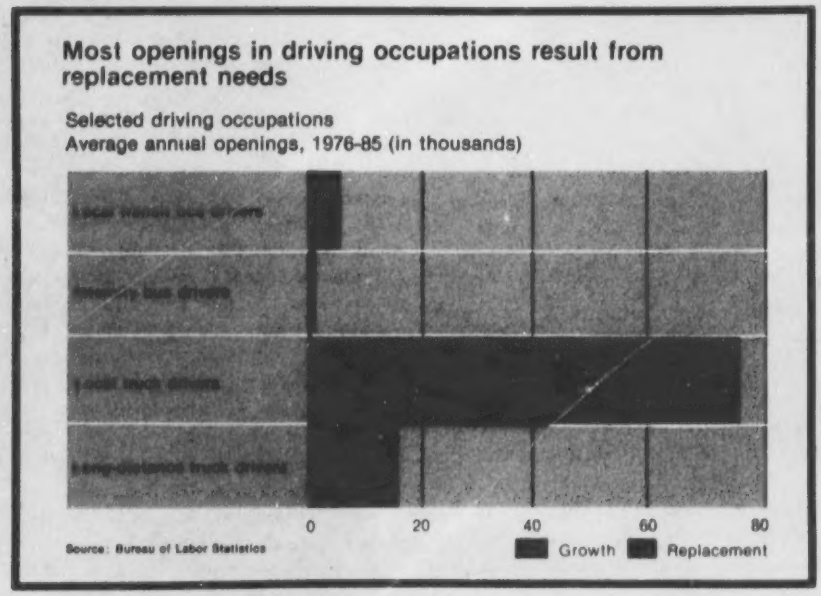
Most track workers are members of the Brotherhood of Maintenance of Way Employees.

DRIVING OCCUPATIONS

Nearly 2.5 million truck, bus, and taxi drivers moved passengers and goods over highways and city streets in 1976. Some drivers are behind the wheel practically all their working time. Others also spend part of their time loading and unloading goods, making pickups and deliveries, and collecting money. Route drivers do some selling as well as driving. For this reason route drivers are discussed in the chapter on sales occupations elsewhere in the *Handbook*. The individual sections that follow cover long-distance and local truckdrivers, intercity and local busdrivers, parking attendants, and taxi drivers. Not covered are school busdrivers, chauffeurs, ambulance drivers, or employees for whom driving is only incidental to their regular duties.

Employment of long-distance and local truckdrivers is expected to expand through the mid-1980's as more and more freight is moved by trucks. Employment of busdrivers also is expected to increase as intercity passenger travel continues to grow and as cities expand their transit systems. Employment in other driving occupations is not expected to change much, but many new employees will be hired to replace those who retire, die, or stop working for other reasons.

Driving jobs offer excellent opportunities for persons who are not planning to attend college. The pay for most drivers is relatively high, and working conditions are fairly good. Many persons also will enjoy the freedom from close supervision and the frequent contact with people that are characteristic of most driving jobs.



INTERCITY BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

In many smaller towns and cities, buses provide the only public transportation to other communities. In large cities, they are an alternative to railroad and airline transportation and, in many cases, provide more frequent service.

When busdrivers report to the terminal or garage, they are assigned buses and pick up tickets, report blanks, and other items needed for their trips. They inspect their buses carefully to make sure the brakes, steering mechanism, windshield wipers, lights, and mirrors work properly. They also check the fuel, oil, water, and tires, and make certain that the buses are carrying safety equipment, such as fire extinguishers, first-aid kits, and emergency reflectors.

Drivers move the buses to loading platforms where they take on passengers. They collect fares—tickets usually—as passengers board the buses and may use the buses' public address system to announce the destination, route, time of arrival, and other information concerning the trips.

Drivers' routes vary. On local runs, drivers stop at many small towns only a few miles apart. On express runs, however, they may stop only at major cities after several hours of driving. Although drivers must always be alert in preventing accidents, they must be especially careful in fast-moving highway traffic. They must operate the bus at safe speeds while trying to keep schedules, and often must cope with adverse road conditions.

Before arriving at major terminals, they announce the stop and the scheduled departure time. At some small stations, drivers stop only if they see passengers waiting or if they have been told to pick up or deliver freight. Drivers also regulate lighting, heating, and air-conditioning equipment for the passengers' comfort. In an emergency, they are required to change flat tires.

Bus driver checks oil before starting run.

Upon arriving at their final destinations, drivers may unload or supervise the unloading of baggage and freight. They prepare reports for their employers on mileage, time, and fares, as required by the U.S. Department of Transportation. They also report any repairs the buses need before being used again.

At times, drivers operate chartered buses. In these cases, they pick up a group of people, take them to the group's destination, and remain with them until they are ready to return. These trips frequently require drivers to remain away from home one night or more.

Places of Employment

Over 25,000 intercity busdrivers were employed by about 950 bus companies in 1976. Some work out of terminals located in some of the small communities served by buses, but most work out of major terminals in large cities.

Training, Other Qualifications, and Advancement

Intercity busdrivers must meet qualifications established by the U.S. Department of Transportation. Drivers must be at least 21 years old and be able to read, write, and speak English well enough to communicate with passengers and to complete reports. They also must have good hearing, at least 20/40 vision in each eye with or without glasses, and normal use of their arms and legs. In addition, they must take comprehensive written examinations which test their knowledge of Department of Transportation and State motor vehicle regulations, as well as a driving test in the type of bus they will operate. Most States require that drivers have a chauffeur's license, which is a commercial driving permit.

Many intercity bus companies have considerably higher requirements. Most prefer applicants who are at least 25 years of age; some prefer applicants who have bus or truckdriving experience. One large company requires applicants to have 20/20 vision with or without glasses.

Since they represent their companies in dealing with passengers, busdrivers must be courteous and tactful. An even temperament and emotional stability are important qualifications, because driving buses in heavy, fast-moving traffic and dealing with passengers can be a strain.

Most intercity bus companies conduct training programs for new drivers. These programs, which usually last from 2 to 8 weeks, include both classroom and driving instruction. In the classroom, trainees learn about rules of the company and the U.S. Department of Transportation, about State and municipal driving regulations, and about safe driving practices. They also learn how to determine ticket prices and how to keep records. In addition, new employees learn to deal courteously with passengers.

Trainees spend considerable time learning and practicing driving skills. Courses are set up and trainees practice turns, zig-zag maneuvers, backing up, and driving into narrow lanes. A good deal of practice is necessary before trainees can adapt their automobile driving skills to these larger vehicles. Trainees ride with regular drivers to observe safe driving practices and other aspects of the job. They also make trial runs, without passengers, to improve their driving skills. After completing the training, which includes final driving and written examinations, new drivers begin a "break in" period. During this period, they make regularly scheduled trips with passengers, accompanied by an experienced driver. The experienced driver gives helpful tips, answers questions, and determines that the new driver is performing satisfactorily.

New drivers start out on the "extra board," which is a list of drivers who are given temporary assignments. While on this list, they may substitute for regular drivers who are ill or on vacation, or they may drive chartered buses. Extra drivers may have to wait several years before they have

enough seniority to get a regular assignment.

Opportunities for promotion generally are limited, particularly in small companies. For most drivers, advancement consists of receiving better driving assignments in the form of higher earnings or a more leisurely route. Experienced drivers may be promoted to jobs as dispatchers, supervisors, or terminal managers.

Employment Outlook

Employment of intercity busdrivers is expected to increase about as fast as the average for all occupations through the mid-1980's. Additional openings will become available each year because of the need to replace experienced drivers who retire, die, or transfer to other occupations. Since many qualified persons are attracted to this relatively high paying job, applicants can expect stiff competition for the openings that arise. Applicants in excellent physical condition who have good driving records stand the best chance of being hired.

A growing population is expected to lead to a moderate increase in bus travel. However, should government energy policies make gasoline for automobiles very expensive or difficult to obtain, many persons may ride buses rather than drive their own cars, thus increasing the demand for intercity busdrivers.

Earnings and Working Conditions

Drivers employed by large intercity bus companies had estimated annual average earnings of $16,100 in 1976, about three-quarters more than the average for all nonsupervisory workers in private industry, except farming. The wages of intercity busdrivers typically are computed on a mileage basis, but short runs may be on an hourly rate. Most regular drivers are guaranteed a minimum number of miles or hours per pay period. For work on other than regular assignments they receive additional pay, customarily at premium rates.

Since intercity buses operate at all hours of the day and every day of the year, drivers may work nights and weekends. Extra drivers may be on call at all hours and may be required to report for work on very short notice. Drivers on some long routes have to remain away from home overnight. Driving schedules may range from 6 to 10 hours a day and from 3-1/2 to 6 days a week. However, U.S. Department of Transportation regulations specify that intercity drivers shall not drive more than 10 hours without having at least 8 hours off, and shall not drive at all after being on duty for 15 hours.

Driving an intercity bus usually is not physically difficult, but it is tiring and requires steady nerves. The busdriver is given a great deal of independence on the job, and is solely responsible for the safety of the passengers and bus. Many drivers like working without direct supervision and take pride in assuming these responsibilities. Some also enjoy the opportunity to travel and to meet the public.

Most intercity busdrivers belong to the Amalgamated Transit Union. The Brotherhood of Railroad Trainmen, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.) also have organized these workers in some areas of the country.

Sources of Additonal Information

For further information on job opportunities in this field, contact intercity bus companies or the local office of the State employment service.

LOCAL TRANSIT BUSDRIVERS

(D.O.T. 913.363 and 913.463)

Nature of the Work

Local transit busdrivers relieve millions of Americans of the bother of fighting city traffic every day. These drivers follow definite time schedules and routes over city and suburban streets, to provide passengers with an alternative to automobile driving and even ownership.

The workday for local busdrivers begins when they report to the terminal or garage to which they are assigned. Large cities have several garages while a small city may have only one. At the garage, drivers are given transfer and refund forms. Some are assigned buses and drive them to the start of their run. Others go to designated intersections and relieve drivers who are going off duty. Drivers inspect the inside and outside of the buses and check the tires, brakes, windshield wipers, and lights before starting their runs. Those who work for small bus companies also may check the water, oil, and fuel.

On most runs, drivers pick up and discharge passengers at locations marked with a bus stop sign. As passengers board the bus, drivers make sure the correct cash fare, token, or ticket is placed in the fare box. They also collect or issue transfers. Drivers often answer questions about schedules, routes, and transfer points, and sometimes call out the name of the street at each bus stop.

A busdriver's day is run by the clock, as they must pay special attention to their complicated schedules. Although drivers may run late in heavier than average traffic, they avoid letting light traffic put them ahead of schedule so that they do not miss passengers.

Busdrivers especially must be alert to the traffic around them. Since sudden stops or swerves will jar standing passengers, drivers try to anticipate traffic developments, not react to them.

At the end of the day, busdrivers turn in trip sheets which usually include a record of fares received, trips made, and any significant delays in schedule. They also turn in a report on the mechanical condition of the bus that day. In case of an accident, drivers must make out a report describing exactly what happened before and after the event and obtain the names, addresses, and phone numbers of persons on the bus.

More local busdrivers will be needed to relieve traffic congestion.

At times, drivers operate chartered buses—buses arranged for in advance by an organization or group. In these cases, they pick up a group of people, take them to their destination, and remain with them until they are ready to return.

Places of Employment

About 81,000 local busdrivers were employed in 1976. About four-fifths worked for publicly owned transit systems. Most of the remainder worked for privately owned transit lines; a small number worked for sightseeing companies. Most busdrivers work in large cities.

Training, Other Qualifications, and Advancement

Applicants for busdriver positions should be at least 21 years old, be of average height and weight, be in good health, and have good eyesight—with or without glasses. Most employers require applicants to pass a physical examination and a written test that determines if they are capable of following the often complex schedules busdrivers use. Although educational requirements are not high, many employers prefer applicants who have a high school education or its equivalent. A relaxed personality is important since drivers face many minor aggravations each day due to traffic congestion, bad weather, and the many different personalities they must deal with.

A motor vehicle operator's license is a basic requirement. A good driving record is essential because the busdriver is responsible for passenger safety. Most States require busdrivers to have a chauffeur's license, which is a commercial driving permit.

Most local transit companies conduct training courses that may last several weeks and include both classroom and "behind-the-wheel" driving instruction. In the classroom, trainees learn company rules, safety regulations, and safe driving practices. They also learn how to keep records and how to deal tactfully and courteously with passengers. Actual driving instruction may begin with several hours of instruction on a training course, but trainees quickly advance to practice on city streets. Because a busdriver is seated above other traffic, defensive driving—seeing and avoiding possible traffic dangers ahead of time—has much potential and is stressed. Trainees are assigned to a particular garage, and must memorize and drive each of the runs based at this garage before graduating. They also take several trips with passengers while supervised by an experienced driver. At the end of the course, trainees may have to pass a written examination and a driving examination.

Most drivers have regularly scheduled runs. New drivers, however, often are placed on an "extra" list to substitute for regular drivers who are ill or on vacation. New drivers also may be assigned to make extra trips during morning and evening rush hours. They remain on the extra list until they have enough seniority to get a regular run. This may take several months or more than a year.

The different runs are assigned on the basis of length of service, or seniority. Therefore, as drivers develop seniority they can choose runs they prefer, such as those that lead to overtime, or that have little traffic.

Opportunities for promotions generally are limited, although experienced drivers may advance to jobs such as instructor, supervisor or dispatcher. Supervisors patrol the bus routes and check whether drivers are on schedule. If a schedule becomes impossible to meet due to heavy traffic, a blocked street, or some other problem, the supervisor may reroute buses. Dispatchers work in the transit system's main office and organize the day to day bus operation by coordi-

nating all activity. They assign buses to drivers, determine that drivers are available for all runs, call extra list drivers to substitute if experienced drivers will be out, and keep a record of the drivers and buses that were assigned to each run. A few drivers advance to management positions. Promotion in publicly owned bus systems is usually by competitive civil service examination.

Employment Outlook

Employment of local busdrivers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition, many job openings will result from the need to replace drivers who transfer to other occupations, retire, or die.

The increased use of privately owned automobiles in cities and the population shift to the suburbs—where most people drive their own cars—has caused a decline in bus passengers and driver employment. However, in urban areas, the automobile now is recognized as the main source of air pollution and traffic congestion. As part of the effort to reduce the number of cars used by commuters, many cities are trying to improve local bus service. Some now have commuter buses with reserved seats. In addition, express lanes reserved for buses on city streets, more convenient routes, and more comfortable buses reflect the impact of Federal, State, and local government interest in providing better bus service. Improved bus service will require more drivers.

Earnings and Working Conditions

According to a survey of union contracts in 67 large cities, local busdrivers averaged $6.53 an hour in 1976, about one-third more than the average for all nonsupervisory workers in private industry, except farming. Hourly wages were highest in the larger cities. Wage scales for beginning drivers were generally 10 to 20 cents an hour less.

The workweek for regular drivers usually consists of any 5 days during the week; Saturdays and Sundays are counted as regular workdays. Some drivers have to work evenings and after midnight. To accommodate the demands of commuter travel, many local busdrivers have to work "split shifts." For example, a driver may work from 6 a.m. to 10 a.m., go home, and then return to work from 3 p.m. to 7 p.m. Drivers may receive extra pay for split shifts.

Driving a bus is not physically strenuous, but busdrivers may suffer nervous strain from maneuvering a large vehicle through heavy traffic while dealing with passengers. However, local busdrivers enjoy steady year-round employment, and work without close supervision.

Most local busdrivers are members of the Amalgamated Transit Union. Drivers in New York City and several other large cities belong to the Transport Workers Union of America. The United Transportation Union and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America also have organized some local busdrivers.

Sources of Additional Information

For further information on employment opportunities, contact a local transit system or the local office of the State employment service.

LOCAL TRUCKDRIVERS

(D.O.T. 900.883, 902.883, 903.883, 906.883, and 909.883)

Nature of the Work

Although goods from near and far may begin their trip to customers by trucks, trains, ships, or planes, final deliveries almost always are made by truck. Local truckdrivers move goods from terminals and warehouses to factories, stores, and homes in the area. They are skilled drivers who can maneuver trucks into tight parking spaces, through narrow alleys, and up to loading platforms.

When local truckdrivers arrive at the terminal or warehouse, they receive assignments from the dispatcher to make deliveries, pickups, or both. They also get delivery forms and check the condition of their trucks. Before the drivers arrive for work, material handlers generally have loaded the trucks and arranged the items in order of delivery to minimize handling of merchandise.

At the customer's place of business, drivers generally load or unload the merchandise. If there are heavy loads such as machinery, or if there are many deliveries to make during the day, drivers may have helpers. Drivers of moving vans usually have crews of helpers to assist in loading and unloading household or office furniture.

Drivers get customers to sign receipts for the goods, and may receive money for the material delivered. At the end of the day, they turn in receipts, money, and records of the deliveries made. They also report whatever repairs the trucks need before being used again.

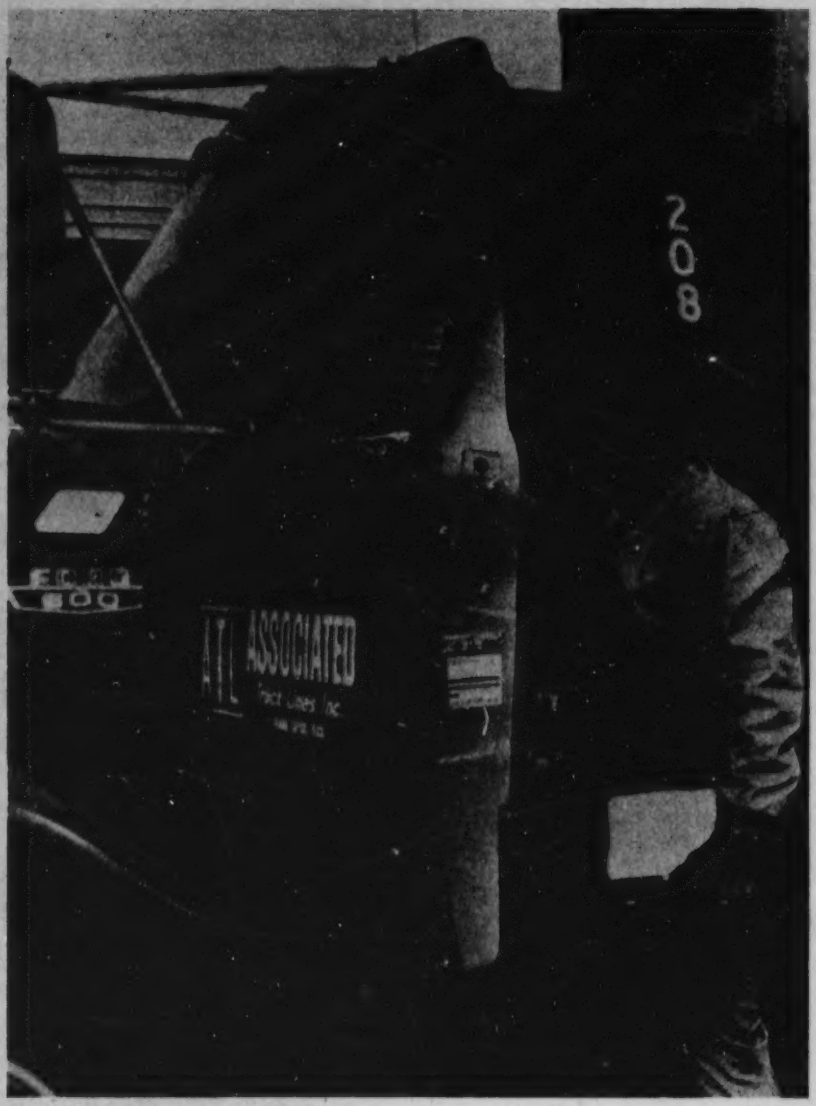
The work of these drivers varies, depending on the product they transport. Produce truckers, on the one hand, pick up a loaded truck in the early morning and spend the rest of the day delivering the product to many different grocery stores. The day for a driver of a lumber truck, on the other hand, consists of several round trips between the lumber yard and one construction site or more.

Places of Employment

About 1.6 million people worked as local truckdrivers in 1976, mostly in and around large cities. Some drivers are needed in almost all communities, however.

Most local drivers work for businesses which deliver their own products and goods—such as department stores, foodstores, and lumber yards. Many others are employed by trucking companies. Some work for Federal, State and local government agencies.

A large number of local truckdrivers are owner-operators. Drivers who own one or two trucks account for a sizable proportion of the local for-hire trucking industry.



About 1.6 million people worked as local truckdrivers in 1978.

Training, Other Qualifications, and Advancement

Qualifications for local truckdrivers vary considerably, depending upon the type of truck and the nature of the employer's business. In most States, however, applicants must have a chauffeur's license, which is a commercial driving permit. Information on how to get this license can be obtained from State motor vehicle departments. Applicants may have to pass a general physical examination, a written examination on driving regulations, and a driving test. They should have good hearing and at least 20/40 vision, with or without glasses, be able to lift heavy objects, and be in good health.

Employers prefer applicants with some previous experience driving a truck. A person may obtain such experience by working as a truckdriver's helper. Employers also give consideration to driving experience gained in the Armed Forces. Many drivers start out as dock workers, loading and unloading freight. They get a general idea of the trucking operation and their work may give them the opportunity to move trucks around the yard. When a need for a truckdriver develops, a capable dock worker may be promoted.

Since drivers often deal directly with the company's customers, the ability to get along well with people is important. Employers also look for responsible, self-motivated individuals, since drivers work with little supervision. Many employers will not hire applicants who have bad driving records.

Training given to new drivers usually is informal, and may consist only of a few hours instruction from an experienced driver, sometimes on the new employee's own time. New drivers also may ride with and observe experienced drivers before being assigned their own runs. Additional training may be given if they are to drive a special type of truck. Some companies give 1 to 2 days of classroom instruction which covers general duties, the efficient operation and loading of a truck, company policies, and the preparation of delivery forms and company records.

Although most new employees are assigned immediately to regular driving jobs, some start as extra drivers and do the work of regular drivers who are ill or on vacation. They receive a regular assignment when an opening occurs.

Local truckdrivers may advance to dispatcher, manager, or to traffic work—for example, planning delivery schedules. However, relatively few of these jobs are available. For the most part, a local truckdriver may advance to driving heavy or special types of trucks or by transferring to long-distance truckdriving. Local drivers working for companies that also employ long-distance drivers have the best chances of advancing to these positions. Experienced drivers who have business ability can become owner-operators when they have enough money to purchase a truck.

Employment Outlook

Employment of local truckdrivers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the job openings from growth,

thousands of openings will result from the need to replace experienced drivers who transfer to other occupations, retire, or die. Job openings may vary from year to year, however, since the number of drivers needed fluctuates with general business conditions. Applicants with good driving records have the best chance of being hired.

The rise in total business activity anticipated in the years ahead will increase the amount of freight to be distributed. Since trucks carry virtually all local freight, employment of drivers will grow.

Earnings and Working Conditions

On the average, union wage scales were $7.22 an hour for local truckdrivers and $6.59 an hour for helpers in 1976, according to a survey in 70 large cities. This is about 1 1/2 times as much as the average for all nonsupervisory workers in private industry, except farming.

As a rule, local truckdrivers are paid by the hour and receive extra pay for working overtime, usually after 40 hours. Some drivers are guaranteed minimum daily or weekly earnings. Local truckdrivers frequently work 48 hours or more a week. Night or early morning work is sometimes necessary, particularly for drivers handling foodstuffs for chain grocery stores, produce markets, or bakeries. Most drivers deliver over regular routes, although some may be assigned different routes each day.

Truckdriving has become less physically demanding because most trucks now have more comfortable seating, better ventilation, and improved cab designs, but when drivers make many deliveries during a day, their work can be exhausting. Moreover, driving in heavy traffic can cause nervous strain. Local truckdrivers, however, do have certain work advantages. Employment is steady and, unlike long-distance drivers, they usually work during the day and return home in the evening.

Many local truckdrivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some local truckdrivers employed by companies outside the trucking industry are members of unions that represent the plantworkers of their employers.

Sources of Additional Information

Information on truck driver training schools and on career opportunities in the trucking industry may be obtained from:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

For details on truck driver employment opportunities, contact local trucking companies or the local office of the State employment service.

LONG-DISTANCE TRUCKDRIVERS

(D.O.T. 903.883, 904.883, 905.883, and 909.883)

Nature of the Work

At all hours of the day and night big trucks travel along turnpikes and highways carrying goods between terminals that are hundreds, or even thousands of miles apart. Behind the wheel are the top professional drivers. They drive the largest and most expensive equipment and receive the highest wages of all drivers.

The runs of long-distance truckdrivers vary widely. Some drivers have short "turnarounds". They deliver a load to a nearby city, pick up another loaded trailer, and drive it back to their home base the same day. Others are assigned runs that take an entire day to complete, and they remain away from home overnight. Often on these longer runs, drivers are assigned loads going to other cities rather than back to their home bases, and may continue to haul loads from city to city for as long as a week before returning home. Some companies use two drivers on very long runs. One drives while the other sleeps in a berth behind the cab. These "sleeper" runs may last for days, or even weeks at a time.

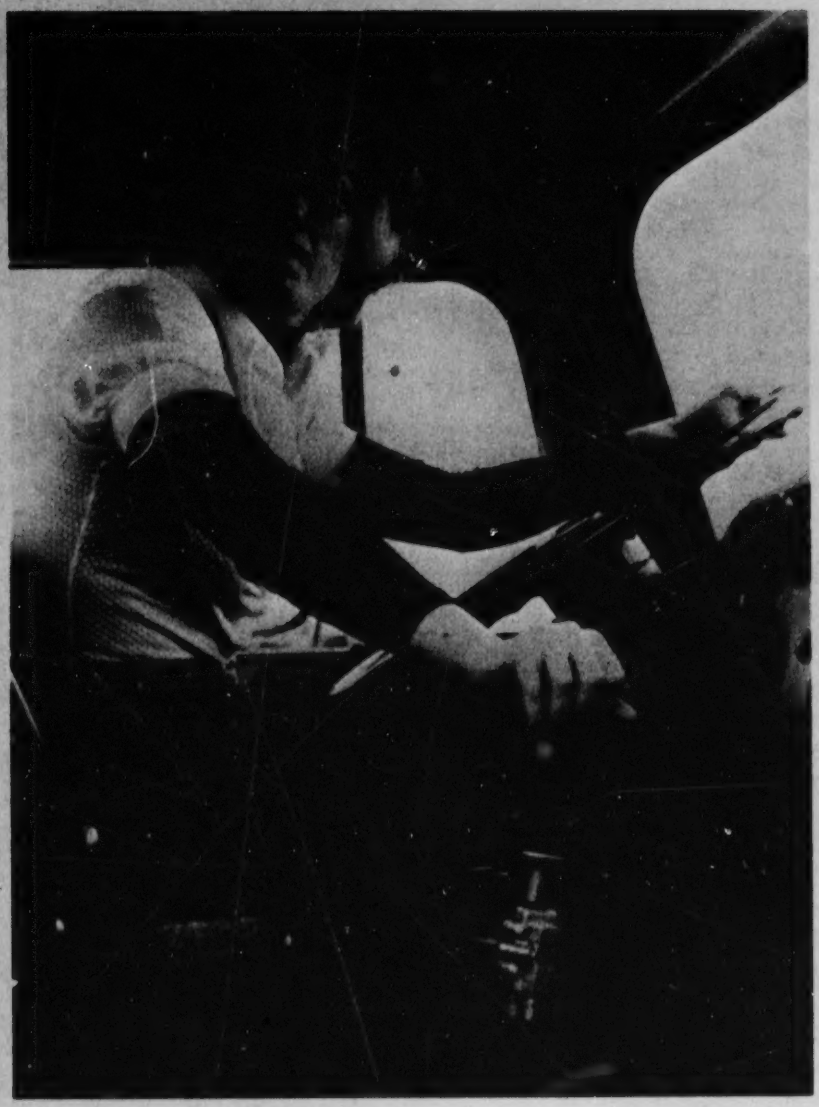
In most cases, dispatchers tell long-distance drivers when to report for work and where to take the truck. Although many drivers work during the day, night travel is common and frequently preferred because roads are less crowded and trips take less time.

When the drivers report for work, the trucks already have been loaded and serviced with fuel and oil. But, before moving from the terminal, drivers inspect the trucks to make sure they will operate safely. For example, they make sure the brakes, windshield wipers, and lights are working and that a fire extinguisher, flares, and other safety equipment have been loaded. Mirrors are adjusted so that both sides of the truck are visible from the driver's seat. Drivers also make sure the cargo has been loaded properly and will not shift after the trip has begun. If some equipment does not work, or is missing, or if the cargo is not loaded properly, drivers report the problem to the dispatcher for correction.

Once they are on the road, drivers must be alert not only to prevent accidents, but also to drive their trucks efficiently. Because of the truck's size, drivers sit higher than the cars, pickups, or vans surrounding them, and have the advantage of being able to see far down the road. They seek traffic lanes that allow them to move at a steady speed, and when going downhill they may increase speed slightly to gain momentum for a hill ahead.

To avoid the drowsiness caused by traveling for hours, drivers may stop to eat, refuel, and relax during a run. After they have reached their destination and have parked at the unloading platform, drivers complete reports about the trip and the condition of the truck. Both are required by the U.S. Department of Transportation. If they have had an accident during the trip, a detailed report of the incident is required.

Long-distance truckdrivers spend most of their working time behind the wheel. Drivers hauling some specialty cargo, though, often load or



A significant number of drivers are owner-operators.

unload their trucks, since they may be the only individuals at the destination familiar with this procedure. Auto transport drivers, for example, drive and position the cars on the racks and remove them at the final destination. Gasoline tank truckdrivers attach the hoses and operate the pump on their truck to transfer the gasoline to the gas station's storage tank. When picking up or delivering furniture, drivers of long-distance moving vans hire local labor, which they supervise, to help them load or unload the van.

Places of Employment

An estimated 467,000 long-distance drivers were employed in 1976. Most live near large cities and manufacturing centers that have many truck terminals. Drivers who specialize in transporting agricultural products or minerals may live in rural areas.

A large proportion of long-distance truckdrivers work for trucking companies that offer transportation service to businesses in general. Many others work for companies such as furniture manufacturers, which own and operate trucks to deliver their products. A significant number of drivers are owner-operators. These drivers own their trucks and either operate independently or lease their services and their trucks to a trucking company.

Training, Other Qualifications, and Advancement

The U.S. Department of Transportation establishes minimum qualifications for long-distance truckdrivers who are engaged in interstate commerce. A driver must be at least 21 years old and pass a physical examination which the employer usually pays for. Good hearing, 20/40 vision with or without glasses, normal use of arms and legs (unless a waiver is obtained), and normal blood pressure are the main physical requirements.

To be hired, drivers must have a good driving record and must pass a road test to show they can operate a vehicle of the type and size they will drive in regular service. In addition, they must take a written examination on the Motor Carrier Safety Regulations of the U.S. Department of Transportation. In most States, truckdrivers also must have a chauffeur's license, which is a commercial driving permit.

The hiring standards at many trucking operations are higher than those described. Many firms require that new drivers be at least 25 years old. Others specify height and weight limitations. Some companies employ only applicants who have had several years' experience driving trucks long distances.

Driver-training courses are a desirable method of preparing for truck-driving jobs. Most training authorities and employers recommend high school driver-training courses. In addition, a high school course in automotive mechanics helps drivers make minor roadside repairs.

Many truckdrivers start out as dock workers, loading and unloading freight. As they gain experience in the general trucking operation, they may advance to local truckdriving

jobs. Local drivers with good driving records may be offered jobs as long-distance drivers.

A small number of private and public technical-vocational schools offer truckdriving courses. Students learn to inspect the trucks and freight, to drive large vehicles in crowded areas and in highway traffic, and to comply with Federal, State, and local regulations. Completion of a course, however, does not assure a job. Even graduates of these schools who do get truckdriving jobs often start as local drivers. After gaining experience on these smaller trucks and proving their ability, they may advance to long-distance truckdriving. Persons interested in attending one of these schools should check with local trucking companies to make sure the school's training is acceptable.

New drivers usually are given a brief explanation of company policy and are taught how to prepare the various forms used on the job. They also receive a small amount of driving instruction and practice on a training course to learn how to maneuver these larger trucks. They then make one or more training trips under the supervision of an instructor or an experienced driver.

Drivers for large trucking companies frequently start on the "extra board," bidding for runs on the basis of seniority as vacancies occur. (The extra board is a list of drivers, assigned in rotation, who substitute for drivers who have scheduled runs or who make the many unscheduled trips.) Drivers for smaller companies are more likely to be assigned regular routes right away.

Opportunities for promotion in this occupation are limited. A few drivers may advance to jobs as safety supervisor, driver supervisor, and dispatcher. However, such jobs often are unattractive to long-distance truckdrivers, since the starting pay usually is less than the pay for driving. Although most drivers can only expect to advance to driving runs that provide increased earnings or preferred schedules and working conditions, a driver who has business ability and enough money to buy a truck may become an owner-operator.

Employment Outlook

Employment of long-distance truckdrivers is expected to increase more slowly than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, thousands of openings will be created in this large occupation as experienced drivers retire, die, or transfer to other fields of work. Job opportunities may vary from year to year, however, because the amount of freight moved by trucks fluctuates with ups and downs in the economy. Since driver earnings are high and no formal training is required, applicants can expect to face strong competition for available jobs.

The general economic growth of the Nation is expected to increase the amount of freight that will be carried long distances by truck, thus increasing the demand for drivers. But the demand for drivers is expected to increase more slowly than the growth in freight because larger trucks should increase the amount of freight each driver can haul.

Earnings and Working Conditions

Based on limited information, drivers employed by large trucking companies had annual average earnings of about $17,700 in 1976, about double the average of all nonsupervisory workers in private industry, except farming. Pay rates are fairly uniform because this field is highly unionized, and union contracts generally are master agreements covering all employers within a multi-State region. However, the earnings of individual drivers vary, depending on mileage driven, number of hours worked, and type of truck.

Some companies outside the trucking industry, such as bakeries and dairies, may pay drivers who work for them on the same basis as they pay their other employees—a monthly, weekly, or daily wage. Generally, such a wage is for a specified number of hours, and, if drivers work additional hours, they receive extra pay.

Trucking companies engaged in interstate commerce are subject to the U.S. Department of Transportation rules governing hours of work and other matters. These regulations limit the hours drivers may work and assure a reasonable amount of time for rest. For example, a driver cannot be on duty for more than 60 hours in any 7-day period, and cannot drive more than 10 hours without being off duty at least 8 hours. Many drivers, particularly on very long runs, work fairly close to the maximum hours permitted. A workweek of at least 50 hours is very common.

Long-distance truckdrivers often must spend time away from home. In such instances, the company provides lodging either in a company dormitory or a hotel or motel.

The physical strain of long-distance driving has been reduced by more comfortable seating, better ventilation, and improved cab design. Better highways and more stringent safety regulations have made trucking safer. However, the noise and vibration of the truck and the nervous strain of sustained driving are tiring.

Most long-distance drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some drivers outside the trucking industry belong to the unions that represent plant employees of the companies for which they work.

Sources of Additional Information

Information on truckdriver training schools and career opportunities in the trucking industry may be obtained from:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

Additional details on truckdriver employment opportunities may be obtained from local trucking companies or local offices of the State employment service.

PARKING ATTENDANTS

(D.O.T.915.878)

Nature of the Work

Parking attendants park customers' cars and collect payment for the time they are left on the lot or in the garage. Attendants meet incoming cars and record their time of arrival on numbered claim checks. One part of the check is placed on the car's windshield and the other is given to the driver to reclaim his or her car.

In lots where cars are parked bumper to bumper, parking attendants may ask customers when they expect to return so their cars will be more readily accessible when they need them.

Attendants usually drive the cars to and from vacant spaces, but at some facilities they tell drivers where to park. Attendants working in multilevel garages may be assigned to only one level, but the usual practice is for attendants to work all levels.

Some parking lots require customers to pay when entering the lot and usually charge a flat fee for the day or evening. Others charge by the hour and attendants must determine the correct amount owed by each customer. In large establishments, a cashier, rather than an attendant, will collect payments. Slack periods are common at most parking facilities. However, attendants may be required to perform routine maintenance jobs such as cleaning and sweeping the lot.

More than a third of all parking attendants work part time.

Places of Employment

About 40,000 parking attendants were employed in 1976. Parking attendants work in facilities ranging from small outdoor lots to large parking garages. Most of these are in urban areas. Parking lots and garages usually are commercial establishments and often are part of city, regional, or national chains. Although many restaurants, hotels, and stores maintain their own lots, it is also a common practice to rent parking space for their customers in commercial garages. Many cities own and operate their own lots in downtown areas.

More than a third of all parking attendants work part time, usually during the busy afternoon rush hours, in the evening, and on weekends. Most part-time attendants are students.

Training, Other Qualifications, and Advancement

Although there are no specific educational requirements for parking attendants, employers prefer high school graduates. Parking attendants must have a valid driver's license, be able to drive a car with a standard transmission, and have good eyesight and peripheral vision. Applicants with experience driving many different types of cars are preferred. Attendants must also be able to keep records of claim tickets, compute parking charges, and make change.

Attendants should be in good physical condition because the work involves long periods of standing and can be tiring when many cars must be moved in a hurry. Parking attendants should be neat, tactful, and courteous when dealing with the public.

Most parking attendants are trained on the job. Beginners may "ride" with an experienced worker for a few hours or days to become familiar with the work. Many employers also provide on-the-job training programs that review proper driving techniques and explain company policy on recordkeeping procedures and damage claims. These courses usually include tips on how to maintain good customer relations.

Some attendants become managers of parking facilities. An exceptional attendant eventually may become a supervisor of several facilities. Supervisors regularly visit the parking facilities they oversee to check the work of managers, the appearance of the facilities, and the neatness of the attendants.

Students interested in management jobs in the parking industry should consider taking part-time or summer jobs as attendants, because even large companies want their employees to have first-hand experience with the business.

Employment Outlook

Employment of parking attendants is expected to grow more slowly than the average for all occupations through the mid-1980's as the trend to self-parking systems continues. Parking owners prefer the self-park method because it is less costly and because most customers prefer to park their own cars rather than wait for a busy attendant.

Although employment growth is expected to be slow, turnover in this occupation, especially among new workers, is higher than average. The need to replace these workers and those who retire or die will create additional job openings each year. Part-time and evening work will be available. Most job opportunities will be in large commercial parking facilities in urban areas.

Earnings and Working Conditions

Most parking attendants are paid the minimum wage. The Federal minimum was $2.20 - $2.30 an hour in 1976, but some cities and States have their own minimum wage laws which establish higher rates. Experienced attendants who have taken on additional responsibility may earn higher salaries. Nearly all attendants receive tips in addition to wages that add substantially to their income. Many parking attendants receive fringe benefits such as life, health, and disability insurance; pension plans; paid vacations; a Christmas bonus; and profit sharing. Some companies furnish uniforms.

Attendants often work long hours. A 10-hour day and work at nights, on weekends, and on holidays are not unusual. In addition, many attendants spend much time outdoors in all kinds of weather and constantly breathe automobile exhaust fumes. In some companies, attendants are responsible for any damage they do to customers' cars.

The principal union organizing parking attendants is the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America.

Sources of Additional Information

For general information about the parking industry and parking attendants in particular, write:

National Parking Association, 1101 17th St. NW., Washington, D.C. 20036.

TAXICAB DRIVERS

(D.O.T. 913.363)

Nature of the Work

In practically all communities, taxicabs are an essential part of the public transportation system. Unlike buses and subways, which run on fixed routes and schedules, taxis offer individualized service. They pick up passengers at any location and drive them directly to their destination.

Most taxicab drivers either work directly for a cab company or rent their cabs from a company. Others own their taxicabs and operate independently. Whether they are employees, renters, or owners, cab drivers have the same duties.

Cab drivers get many of their passengers by radio dispatching since customers often call cab companies, giving information on where they want to be picked up and what their destination is. A dispatcher at the company then uses a two way radio to pass this information on to a cab driver who is near the customer. Because this is an efficient method of getting passengers, cab drivers who own their own cabs often pay a cab company for using its dispatching service. Between radio calls, or just because they prefer it, drivers may cruise busy areas and watch for potential customers. Drivers also may wait at hotels, bus terminals, and other places where they expect business to be good.

Because cab drivers either rent their cabs or are paid on a commission basis, the more business they get, the higher their earnings. Therefore, experienced drivers often plan their entire day. They know that different parts of the city will have potential customers at different times of the day. They may cruise the business district during rush hour and the shopping centers in the afternoon. Smart drivers also keep informed on where crowds are likely to gather. For example, drivers may go to the airport the evening a convention is coming to town, drop by the station when a train is scheduled to arrive, or stop at the stadium at the end of a ball game.

Occasionally, drivers may help passengers in and out of the cab and may handle their luggage. In some communities, drivers regularly transport handicapped children to and from school. Cab drivers also may provide sightseeing tours for out-of-town visitors and may pick up and deliver packages. In small companies, drivers often are responsible for keeping their cabs clean.

By law, drivers have to keep records of such basic facts as the date, time, and place passengers were picked up and their destination, time of arrival, and fare. Knowing where a driver was during the day serves many purposes, including protecting the driver from mistaken identification in case of a customer complaint.

Places of Employment

In 1976, about 94,000 taxicab drivers worked full time in the taxicab industry. Although taxicab drivers are employed in all but the smallest cities, employment is concentrated in large metropolitan areas. About one-fifth of all full-time taxi drivers work in New York City.

Training, Other Qualifications, and Advancement

Taxi drivers usually must have a State-issued chauffeur's license and a special taxicab operator's license issued by the local police, safety department, or Public Utilities Commission. Requirements for a taxicab operator license vary from city to city, but applicants generally must be in good health, have a good driving record, and not have been convicted of a serious crime.

In most large communities, applicants for a taxi driver's license must pass a written examination on taxicab and traffic regulations. The examination usually includes questions on the geography of the community, such as the location of important streets and buildings, and questions on local taxicab regulations. These may include regulations concerning lost articles, the number of passengers allowed in a cab, the pick-up and delivery of packages, and zoning or meter rules.

Since the procedure required to get a taxicab license may seem complicated, applicants are advised to first visit cab companies for which they would like to work. Most companies will explain what is required in order to get a license and how to go about getting one. Some will also help applicants prepare for the examination.

Although there are no minimum education requirements, many companies prefer applicants who have at least an eighth-grade education. Applicants also must be able to write legibly in order to complete the forms drivers are required to fill out. Because of automobile insurance regulations, a large number of taxicab companies hire only applicants who are at least 21, and in some cases, 25 years old. In some States, however, companies may hire applicants who are only 18.

People interested in a job as a taxicab driver should enjoy driving and like meeting people. Tact and courtesy are important. A relaxed personality also is an asset, since drivers deal with heavy city traffic most of the day. To be successful,

drivers also need to be capable of motivating themselves, since their earnings depend directly on their ability and hard work.

Opportunities for advancement are limited by the small number of supervisory positions. Promotion to the job of dispatcher is often the only possibility. Some drivers, however, have become road supervisors, garage superintendents, or claims agents. A few develop administrative skills and advance to managerial positions in the company. To increase their income, many drivers buy and operate their own cabs.

Employment Outlook

Opportunities for employment should be excellent through the mid-1980's. Although employment of taxicab drivers is expected to decline, the high turnover of employed drivers should create many jobs.

Many taxicab drivers are temporary employees. Some are working to earn money until they finish school or until they find the job they want; others work to earn money for a special purpose, such as a vacation. After a period of weeks or months, whenever these drivers have obtained other jobs or paid their bills, they quit. As a result, there usually are many taxicab driving jobs available.

Earnings and Working Conditions

In 1976, a private survey reported that taxi drivers averaged $3.40 an hour, including tips. Drivers working directly for a company are paid a percentage—usually between 40 and 50 percent—of their fares for the day. These drivers also may be guaranteed a certain minimum income if fares are low one day. Information from several union contracts indicated that these guarantees ranged from $14 to $18.50 a day in 1976. Other taxi drivers rent their cabs from a company by the day for a set fee, and keep any receipts above the cab rental and gasoline expenses. In addition, drivers frequently receive tips ranging from 10 to 20 percent of the fare.

Many full-time drivers start work between 6 a.m. and 8 a.m. to be available for passengers going to work, and quit after the evening rush of passengers returning home. During the day they may rest for several hours. Other drivers work nights, starting between 3 p.m. and 5 p.m., and some work on Saturdays, Sundays, and holidays.

Taxi drivers in many of the large cities belong to labor unions, particularly those drivers who work for the large taxicab companies. Most drivers are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America. Other unions to which cab drivers belong include the Seafarers' International Union of North America and the Brotherhood of Railway Airline and Steamship Clerks, Freight Handlers Express and Station Employees.

Sources of Additional Information

For further information on job opportunities in this field, contact local cab companies or the local office of the State employment service.

SCIENTIFIC AND TECHNICAL OCCUPATIONS

The efforts of our scientific and technical work force result in improvements in many areas of American life. New products and increased productivity, greater defense capabilities, environmental protection, and advances in health care are examples of the achievements of scientists, engineers, and technicians.

About 2.5 million people (nearly one-quarter of all professional workers) were engineers, scientists, or other scientific and technical workers in 1976.

Engineers

Engineers play a prominent role in bringing scientific progress into our everyday lives. They use scientific and mathematical principles to design and produce new and improved products and to solve practical technical problems such as ways of improving automobile engines to increase gas mileage. Most engineers work in private industry—primarily in industries manufacturing machinery, electrical equipment, and aircraft, and in firms providing engineering and architectural services.

Engineers usually specialize in one of the branches of engineering. (The *Handbook* discusses 12 of these branches.) Many engineers further specialize in an industry such as the motor vehicle industry.

Engineers design, develop, and test equipment; work in the production departments of manufacturing firms; and sell technical products and provide technical assistance to industrial customers. Some work in supervisory and management jobs in which knowledge of engineering is required.

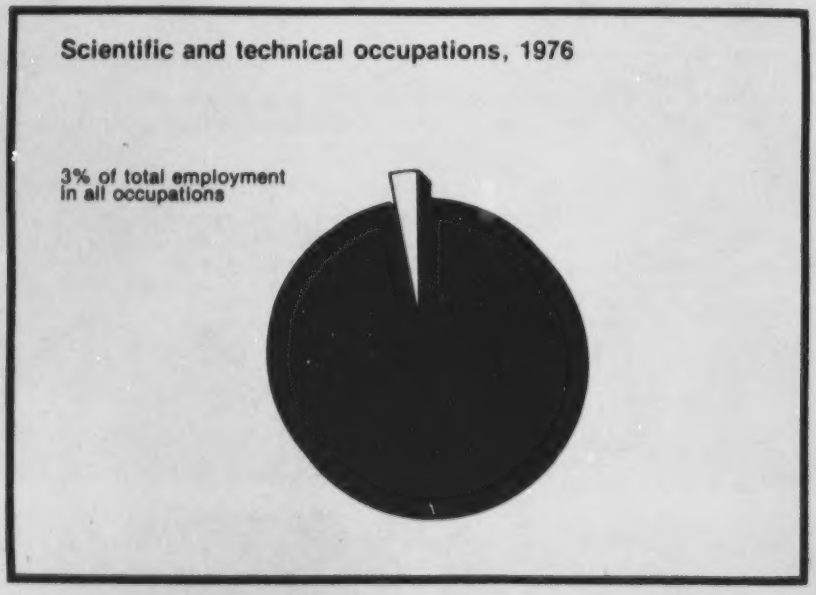
Scientists

Scientists seek knowledge of nature and of the physical world through observation, study, and experimentation. Some scientists develop new products and processes from scientific discoveries. The largest group of scientists study the scientific principles of the physical world; this group includes chemists, physicists, and environmental scientists. More than half of all physical scientists are chemists. Most chemists work in private industry; about one-half are in chemical manufacturing. A quarter of all physical scientists are physicists. Most physicists work in colleges and universities, teaching and doing research, and in private industry—mostly in companies that manufacture aerospace and defense-related products.

Environmental scientists study the earth, its oceans, and its atmosphere. Their work increases understanding of our planet and helps in controlling pollution, discovering and developing natural resources, and in weather prediction. This group includes geologists, meteorologists, and oceanographers. The largest environmental science occupation is that of geologist. Most geologists work in petroleum extraction industries and in colleges and universities.

Life scientists study life processes and living organisms, from the largest animals to the smallest microbes. The majority teach or do research in colleges and universities. Biological scientists are the largest group of life scientists. Medical scientists has been the fastest growing group within the life sciences over the past two decades.

Mathematicians and statisticians also are considered natural scientists. Some mathematicians devote all their time to theoretical research, while others apply mathematical principles to practical problems. Both mathematicians and statisticians work to quantify solutions to problems in science, management, and engineering. Statisticians collect, analyze, and interpret the numerical



results of surveys, quality control tests, or economic and business research programs. In doing so, they assist managers and administrators in making decisions.

Conservationists

Conservationists protect, develop, and manage natural resources such as forests, rangelands, wildlife, soil, and water. By protecting and conserving these assets now, conservationists help assure that future needs will be met.

Foresters help insure that the Nation's forests are used properly. Through the forester's management and research efforts, forests can continually meet many competing uses such as lumber production, recreation, and support of wildlife. Foresters often are assisted by forestry technicians, sometimes called forestry aides.

Range managers determine how rangeland can best support livestock grazing while still conserving it for other uses such as wildlife grazing and recreation.

Soil conservationists provide farmers, ranchers, and others with technical assistance and advice on how to conserve soil and water resources.

Other Scientific and Technical Personnel

More than 900,000 workers in other scientific and technical occupations assist scientists and engineers. These persons work as engineering and science technicians, broadcast technicians, drafters, and surveyors.

Engineering and science technician jobs are more practical and limited in scope than those of engineers and scientists. The more highly skilled jobs, however, require the ability to analyze and solve engineering and science problems and to prepare reports on tests and experiments.

Technicians who work in research and development set up complex laboratory equipment and help design scientific instruments. Those who work in production jobs test and inspect products and act as a liaison between engineering and production departments. Others sell technical products, install complex equipment, and provide technical services to industrial customers.

Broadcast technicians ensure the technical quality of radio and television broadcasts by operating and maintaining sound recorders, television cameras, video tape recorders, and other electronic equipment.

Drafters prepare detailed drawings which show dimensions, material requirements, and other specifications for engineers, architects, and designers.

Surveyors measure construction sites, establish official land boundaries, assist in setting land valuations, and collect information for maps and charts.

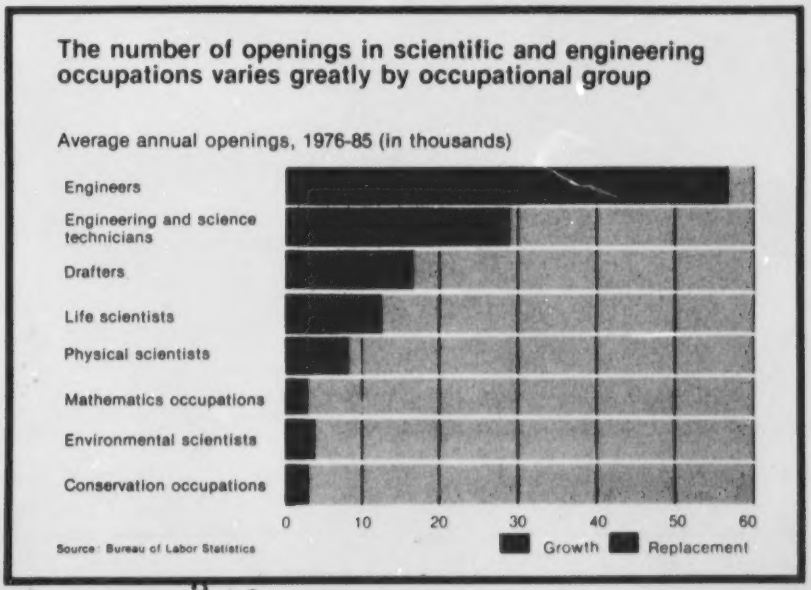
Training

A bachelor's degree is usually needed to enter scientific and engineering jobs. However, increasing emphasis is being placed on advanced degrees in some fields, especially in mathematics, physics, and the life sciences. For some occupations, such as astronomer, a doctorate is required for full professional status. A bachelor's degree is sufficient for entry into most engineering jobs, and some senior engineering technicians with less than a bachelor's degree are occasionally promoted to engineering jobs.

Undergraduate training for scientists and engineers includes courses in their major field and in related science areas, including mathematics. Courses in statistics and computer programming are becoming more important. Students are usually required to take courses in English and a foreign language, as well.

In graduate school, students usually take courses in their major area of study, as well as courses in mathematics and related sciences. Requirements for the master's or doctor's degree vary by institution, but usually include a thesis, which is a report of the results of the student's own original research. Students who want to specialize in a particular area of study should select their schools carefully. For example, those who plan to become biomedical engineers or biochemists and work in medicine should study at a university affiliated with a hospital. Those who want to be agricultural scientists can get the most practical training at State universities that have agricultural experiment stations.

Technicians acquire training in many ways. Some complete on-the-job training programs, take formal courses part time while working, or obtain training in the Armed Forces. Many employers, however, seek graduates of specialized training pro-



grams. One- to four-year training programs are offered in postsecondary schools—technical institutes, junior and community colleges, area vocational technical schools, and colleges and universities.

Outlook

Opportunities in scientific and technical occupations are expected to expand through the mid-1980's. In the past, growth in these occupations has been related to an expanding economy and to increased R&D expenditures, especially by the Federal Government. Both government and industry are expected to increase their R&D expenditures through the mid-1980's although they will increase them more slowly than during the 1960's. If the rate of economic growth and actual R&D levels and patterns differ significantly from those assumed, the outlook in many occupations would be altered.

Scientists, engineers, and other scientific and technical workers will be needed to develop new technologies and better products. In addition, many technically trained people will be required to solve urgent problems such as air, water, and noise pollution, to develop new sources of energy, and to combat disease.

The following sections of the *Handbook* provide detailed information for 4 conservation occupations, 12 engineering specialties, 13 scientific occupations including life, physical, environmental, and mathematical scientists, and 4 related scientific and technical occupations.

CONSERVATION OCCUPATIONS

Forests, rangelands, wildlife, soil, and water are important natural resources. Conservationists protect, develop, and manage these resources to assure that future needs will be met.

Persons interested in a career in conservation must have specialized training. Foresters, range managers, and soil conservationists generally need bachelor's degrees in their fields. Technical school is usually required for positions as forestry technicians. In addition to technical knowledge and skills, conservationists must have a sincere interest in the environment and the desire to protect it. They should enjoy dealing with others and like public service, since they often work with people in the community. Flexibility also is important, since a conservationist may work in a remote camping area one week, speak to a community group the next, and fight a forest or brush fire the next.

This section describes four conservation occupations—forester, forestry technician, range manager, and soil conservationist.

FORESTERS

(D.O.T. 040.081)

Nature of the Work

Forests are a vital natural resource. They can be used repeatedly without being destroyed—if properly managed. The condition of our environment has become a major national concern, and foresters play an important role in protecting that environment by ensuring that our forests are properly used. Foresters manage, develop, and protect these lands and their resources—timber, water, wildlife, forage, and recreational areas.

Foresters plan and supervise the cutting and planting of trees. They also protect the trees from fire, harmful insects, and disease. Foresters may be responsible for other duties ranging from wildlife protection and watershed management to the development and supervision of camps, parks and grazing lands.

Foresters also do research, provide forestry information to forest owners and to the general public (called extension work), and teach at colleges and universities.

Foresters often specialize in one area of work, such as timber management, outdoor recreation, or forest economics. Some of these areas are recognized as distinct professions.

Places of Employment

About 25,000 persons worked as foresters in 1976. Nearly 2 out of 5 worked in private industry, mainly for pulp and paper, lumber, logging, and milling companies. About one-fourth worked for the Federal Government, primarily in the Forest Service of the Department of Agriculture. The remainder worked for State and local governments, colleges and universities, or consulting firms or were self-employed, either as consultants or forest owners.

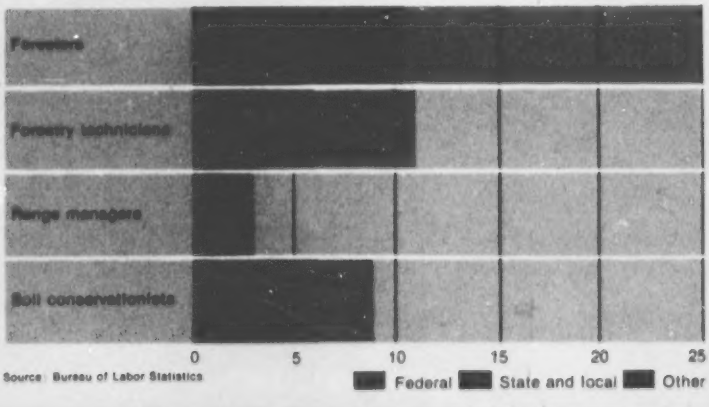
Training, Other Qualifications, and Advancement

A bachelor's degree with a major in forestry is the minimum educational requirement for those desiring professional careers in forestry. However, due to keen job competition and the increasingly complex nature of the forester's work, employers prefer graduates who hold advanced degrees. Certain jobs such as teaching and research require advanced degrees.

Education in forestry leading to a bachelor's or higher degree was offered in 1976 by 50 colleges and universities, of which 43 were accredited by the Society of American Foresters. Curriculums stress the liberal arts and communications skills as well as technical forestry subjects.

About half of all conservationists are employed by Federal, State, and local governments

Employment of conservationists, 1976 (in thousands)



Source: Bureau of Labor Statistics

Foresters spend considerable time outdoors in all kinds of weather.

Most programs also include courses in forest economics and business administration to supplement the student's scientific and technical knowledge. Many colleges require students to spend one summer in a field camp operated by the college. All schools encourage summer jobs that give firsthand experience in forest or conservation work.

In addition to meeting the intellectual demands of forestry, foresters must enjoy working outdoors, be physically hardy, and be willing to move, often to remote places. Foresters should also be able to work well with people and be able to express themselves clearly.

Forestry graduates usually work under the supervision of experienced foresters. After gaining experience, they may advance to more responsible positions. In the Federal Government, an experienced forester may supervise an entire forest area, and may advance to regional forest supervisor or to a top administrative position. In private industry, foresters start by learning the practical and administrative aspects of the business. Many foresters work their way up to top managerial positions within their companies.

Employment Outlook

Employment requirements for foresters are expected to grow about as fast as the average for all occupations through the mid-1980's. In recent years, however, the number of persons earning degrees in forestry has exceeded occupational requirements, creating competition for jobs. If the number of degrees granted each year remains at present levels, competition is expected to persist throughout the period. Opportunities will be better for those who can offer an employer either an advanced degree or several years' experience.

The country will need more foresters in the future to ensure an increasing output of forest products. Employment also may increase as we become more aware of the need to conserve and replenish our forest resources, and to improve the environmental quality of our forest lands.

Private owners of timberland may well employ more foresters as they recognize the need for—and the higher profitability of—improved forestry and logging practices. The forest products industry will require additional foresters to apply new techniques for using the entire forest crop, to develop methods of growing superior trees in a shorter period of time, and to do research in the fields of plant genetics and fertilization.

Employment of foresters will probably continue to grow faster in private industry than in the Federal Government where budget limitations may restrain growth. State government agencies will probably hire more foresters through Federal-State cooperative programs for fire control, protection against insects and disease, recreation, and technical assistance to owners of forest lands.

The expected rapid increase in the employment of forestry technicians will reduce the amount of time spent by foresters in performing routine tasks, but the forester will have to devote more and more time to supervisory work and to the general management of the forest.

Earnings and Working Conditions

The average starting salary for foresters in 1976 was $10,000 a year, while experienced foresters averaged over $18,000, according to the limited data available.

In private industry, starting foresters averaged $10,300 a year in 1976 and the overall average salary was $17,700, according to the limited data available.

Graduates entering the Federal Government as foresters in 1977 with just a bachelor's degree started at $9,303 a year. However, because of keen competition, most foresters hired by the Federal Government either held a master's degree or had some experience, and generally started at $11,523 a year. Ph. D.'s generally started at $14,097 or $17,056 a year. The median annual salary in 1977 for federally employed foresters exceeded $20,000.

In local government, foresters generally began at about $10,700 a year in 1976, while their median annual salary was $15,400. State governments paid about $9,200 annually to start in 1976, and State median salaries were $15,400 per year. College professors generally started at about $11,000 annually in 1976, while their median salary was over $20,000 per year. Many faculty foresters supplement their regular salaries with income from lecturing, consulting, and writing.

Many experienced foresters advance to jobs which require them to spend most of their time in an office. However, the beginning forester spends considerable time outdoors in all kinds of weather, sometimes in remote areas. Foresters may also work extra hours on emergency duty, as in firefighting or search and rescue missions.

Sources of Additional Information

General information about the forestry profession, lists of reading materials, and lists of schools offering education in forestry are available from:

Society of American Foresters, 5400 Grosvenor Lane, Washington, D.C. 20014.

National Forest Products Association, 1619 Massachusetts Ave., NW., Washington, D.C. 20036.

General career information is also available from:

American Forest Institute, 1619 Massachusetts Ave. NW., Washington, D.C. 20036.

American Forestry Association, 1319 18th St. NW., Washington, D.C. 20036.

For details on forestry careers in the Forest Service, contact:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

FORESTRY TECHNICIANS

(D.O.T. 441.137 through 441.887)

Nature of the Work

Forestry technicians, sometimes called forestry aides in entry level positions, assist foresters in the care and management of forest lands and their resources. (See statement on foresters earlier in this chapter.)

Forestry technicians help estimate present and potential timber production in a certain area. If new roads are needed to make the timber accessible for cutting and removal, technicians may supervise the surveying and road building crews. After the timber has been cut, they measure the logs to determine how much lumber the trees will yield and then assist in the sale of the timber.

Technicians work on many forest improvement projects. They inspect trees for disease and other problems, and record their findings. On watershed projects, they work to prevent flood damage and soil erosion and seek ways to increase the quality of water in the forest.

Forestry technicians also help to prevent and control fires. They give fire prevention information to people using the forest and lead firefighting crews if a fire occurs. After fires are extinguished, they take inventory of burned areas and supervise the planting of new trees and shrubs to restore the forest.

Forestry technician measuring the diameter of a tree.

Recreational use of the forest has increased greatly. Technicians maintain forest areas for hunting, camping, hiking, and other recreational activities. They also explain forest regulations and policies to visitors and enforce these rules.

Places of Employment

About 11,000 persons worked year round as forestry technicians in 1976. Nearly the same number found temporary employment—primarily with Federal and State Governments—during the summer or in the spring and fall fire seasons.

Nearly half the year-round total worked in private industry, mainly for logging, lumber, and paper companies. Reforestation projects of mining, oil, and railroad companies—as well as employment in tree nurseries—accounted for the remainder of the workers in private employment. The Federal Government employed about 3,700 full-time forestry technicians in 1976, primarily in the Forest Service of the U.S. Department of Agriculture, while an-

other 2,200 worked for State governments.

Training, Other Qualifications, and Advancement

Most persons qualify for beginning jobs as forestry technicians by completing a specialized course of study in a 1- or 2-year postsecondary school or through work experience on firefighting crews, in tree nurseries, or in recreation work.

Because of keen job competition at the present time, opportunities for employment are better for those with postsecondary school training. In 1976, about 80 technical institutes, junior or community colleges, and universities offered forestry technician training, of which 53 are recognized by the Society of American Foresters.

Most forestry technician schools require graduates to complete general education courses such as mathematics and English, forestry-related courses including biology and botany, and specialized forest technology courses such as land surveying, tree identification, aerial photograph interpretation, and timber harvesting. To gain practical experience, students may be required to work in a forest or camp operated by the school.

Enthusiasm for outdoor work, physical stamina, and the ability to carry out tasks with and without direct supervision are essential for success in this field. Technicians should be able to work with survey crews, users of the forest lands, forest owners, and foresters. They must express themselves clearly when talking to others and when making written reports.

Forestry technicians generally begin work as trainees or in relatively routine positions under the direct supervision of an experienced technician or forester. As technicians gain experience, they are given more responsibility, and often move into supervisory positions. Some technicians obtain bachelor's degrees in forestry and are promoted to the forester level.

Employment Outlook

Growth in employment of forestry technicians is expected to be faster than the average for all occupations through the mid-1980's. Private industry should continue to provide a high proportion of these jobs.

Environmental concern, a rising demand for forest products and increased use of technology in the forest industry are expected to stimulate demand for more technicians each year. Trained technicians will be required to operate specialized and efficient laborsaving machines and to help apply sophisticated scientific methods to forest management. Technicians will also increasingly perform many of the more routine jobs done by foresters.

Despite this expected growth, keen competition for jobs is anticipated. Currently, the number of persons seeking employment as forestry technicians greatly exceeds the jobs available. Unless the number of graduates of forestry technician schools declines substantially in the future, this keen competition for jobs is expected to continue. Those offering specialized forestry technician training and some practical experience may have better opportunities.

Earnings and Working Conditions

Starting salaries of forestry technicians ranged from $7,500 to $10,000 a year in 1976, according to the limited data available; experienced forestry technicians averaged about $12,300.

In the Federal Government, forestry technicians started at $8,316 or $9,303 a year in 1977 depending on education and experience. Experienced forestry technicians in the Federal Government averaged between $12,000 and $13,000 annually.

Forestry technicians spend considerable time outdoors in all kinds of weather, sometimes in remote areas. In emergencies, such as fighting fires and controlling floods, forestry technicians work many extra hours. Climatic conditions often limit year-round field work, and firefighting jobs are limited to the fire season.

Sources of Additional Information

Information about a career in the Federal Government as a forestry technician is available from:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

For a list of schools recognized by the Society of American Foresters offering training in the field write to:

Society of American Foresters, 5400 Grosvenor Lane, Washington, D.C. 20014.

RANGE MANAGERS

(D.O.T. 040.081)

Nature of Work

Rangelands cover more than 1 billion acres of the United States, mostly in the Western States and Alaska. They contain many natural resources: grass and shrubs for animal grazing, habitats for livestock and wildlife, water from vast watersheds, facilities for water sports and other kinds of recreation, and valuable mineral and energy resources. Rangelands also serve as areas for scientific study of the environment.

Range managers, sometimes called *range scientists*, *range ecologists*, or *range conservationists*, manage, improve, and protect range resources to maximize their use without incurring ecological destruction. For example, range managers determine the number and kind of animals to be grazed, the grazing system to be used, and the best season for grazing in order to yield a high production of livestock. At the same time, they must conserve soil and vegetation for other uses such as wildlife habitat, outdoor recreation, and timber production.

Range managers restore and improve rangelands through techniques such as controlled burning, reseeding, and biological, chemical, or mechanical control of undesirable plants. For example, selected rangelands with natural sagebrush vegeta-

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

tion may be plowed and reseeded with a more productive grass. Range managers also determine the need for and carry out range conservation and development such as providing for animal watering facilities, erosion control, and fire prevention.

Not all of the range manager's time is spent outdoors. Office work is not unusual. The range manager may consult with other conservation specialists, prepare written reports, and perform certain administrative duties.

Because of the multiple use of rangelands, range managers often work in such closely related fields as wildlife and watershed management, forest management, and recreation.

Places of Employment

About 3,000 persons worked as range managers in 1976. The majority worked for the Federal Government, principally for the Forest Service and the Soil Conservation Service of the Department of Agriculture and the Bureau of Land Management of the Department of the Interior. Range managers in State governments are employed in game and fish departments, State land agencies, and extension services.

An increasing number of range managers are working for private industry. Coal and oil companies employ range managers to help restore the ecological balance to mined out areas. Banks and real estate firms employ them to help increase the revenue from their landholdings. Other range managers work for private consulting firms and large livestock ranches.

Some range managers with advanced degrees teach and do research at colleges and universities. Others work overseas with United States and United Nations agencies and with foreign governments.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in range management or range science is the usual minimum educational requirement for range managers. In the Federal Government, a degree in a closely related field, such as agronomy or forestry, including courses in range management and range science, may also be accepted. Graduate degrees in range management are generally required for teaching and research positions, and may be helpful for advancement in other jobs.

In 1976, about 20 colleges and universities had degree programs in range management or range science. A number of other schools offered course work in range management.

A degree in range management requires a basic knowledge of biology, chemistry, physics, mathematics, and communication skills. Specialized courses combine plant, animal, and soil sciences with principles of ecology and resource management. Desirable electives include economics, computer science, forestry, wildlife, and recreation.

Federal Government agencies, primarily the Forest Service, the Soil Conservation Service, and the Bureau of Land Management, hire some college students for summer jobs in range management. This experience may better qualify these students for jobs when they graduate.

Besides having a love for the outdoors, range managers should be able to write and speak effectively and work with others. They should have the ability to work alone or under direct supervision. Good physical health and stamina also are important.

Employment Outlook

Employment of range managers is expected to grow faster than the average for all occupations through the mid-1980's. Job opportunities throughout this period are expected to be good for persons with degrees in range management or range science. Also, some jobs may be filled by persons with degrees in related fields who have had some range management courses.

An increasing demand for meat and other rangeland products should stimulate the need for more range managers. Since the amount of rangeland is generally fixed, range managers will be needed to increase the output of rangelands while protecting their ecological balance. Also, more range managers will be needed as the number of large livestock ranches increases.

As oil and coal exploration accelerates, private industry will probably require many more range specialists to rehabilitate ecologically disturbed areas.

The use of rangelands for other purposes such as wildlife protection

and recreation could create additional needs for range managers. Federal hiring for these activities depends heavily upon legislation concerning the management of range resources.

Earnings and Working Conditions

In the Federal Government, range managers with the bachelor's degree started at either $9,303 or $11,523 in 1977, depending on their college grades. Those having 1 or 2 years of graduate work began at $11,523 or $14,097; persons with Ph. D. degrees started at either $14,097 or $17,056 a year. Range managers with the Federal Government averaged about $20,000 a year in 1977.

Salaries for range managers who work for State governments and private companies are about the same as those paid by the Federal Government, according to limited data.

Range managers may spend considerable time away from home working outdoors in remote parts of the range.

Sources of Additional Information

Information about a career as a range manager as well as a list of schools offering training is available from:

Society for Range Management, 2760 W. 5th Ave. Denver, Col. 80204.

For information about career opportunities in the Federal Government, contact:

Bureau of Land Management, Denver Service Center, Federal Center Building 50, Denver, Col. 80255.

Forest Service, U.S. Department of Agriculture, Washington, DC. 20250.

Soil Conservation Service, U.S. Department of Agriculture, Washington, D.C. 20250.

SOIL CONSERVATIONISTS

(D.O.T. 040.081)

Nature of the Work

Soil conservationists provide technical assistance to farmers, ranchers, and others concerned with the conservation of soil and water. They help farmers and other land managers develop programs that make the most productive use of land without damaging it. Soil conservationists do most of their work in the field. If a farmer is experiencing an erosion problem, the conservationist will visit the farm, find the source of the problem, and develop a program to combat the erosion. For example, if the erosion is caused by water runoff on sloped fields, the conservationist may recommend ways to terrace the land, or construct pathways for the runoff that do not remove soil. If erosion results from wind, the conservationist may recommend growing hedges in places that will provide windbreaks or may suggest improved methods of farming, such as leaving the wheat or corn stalks on the field after harvesting to provide ground cover.

Soil conservationist provides farmer with technical assistance.

In many areas of the country—particularly in the West—rainfall is insufficient to permit the growing of crops. Much of this land, however, can be made suitable for grazing livestock if proper water conservation techniques are used. Soil conservationists inspect rangeland and recommend to range managers areas where ponds can be constructed to provide water for livestock. They also recommend solutions to problems of overgrazing, such as seeding grassland or placing salt licks in undergrazed areas to keep the livestock away from areas that have been overgrazed. In this manner they can distribute herds so that the concentration of animals in any one area does not exceed the replaceable food supply.

Soil conservationists pay close attention to weather patterns in order to be aware of conservation problems before they arise. During the winter months, they make periodic snowmobile or ski patrols into the Rockies and other mountainous areas of the West to measure snowfall. This enables them to predict the spring and summer water runoff. In years when the snowfall is light, they alert range managers and farmers to possible water shortages, and develop appropriate water conservation measures.

In addition to working with individual farmers and ranchers, soil conservationists are assigned to work as technical advisors to Soil and Water Conservation Districts when solving areawide land management problems. A Soil and Water Conservation District is made up of a group of individuals within a county who are concerned with, and responsible for, conservation problems within that county. Soil conservationists working with Conservation Districts prepare maps of the district or parts of the district, depicting particular problems of soil and water conservation. They then use the maps to develop a conservation program for the entire area, whether it is only a few farms and ranches or an entire watershed.

Places of Employment

An estimated 7,500 soil conservationists were employed in 1976, mostly by the Federal Government in the U.S. Department of Agriculture's Soil Conservation Service or in the Department of the Interior's Bureau of Indian Affairs. Soil conservationists employed by the Department of Agriculture work as advisors for Soil and Water Conservation Districts in almost every county in the country. Those employed by the Bureau of Indian Affairs generally work near or on Indian reservations, most of which are located in the Western States. In addition to those who work for the Federal Government, others are employed by State and local governments, and some teach at colleges and universities.

Other soil conservationists are employed by rural banks, insurance firms, and mortgage companies that make loans for agricultural lands. A few also work for public utilities, and lumber and paper companies that have large holdings of forested lands.

Training, Other Qualifications, and Advancement

Very few colleges and universities offer degrees with a major in soil conservation. Most soil conservationists, especially those employed by the Soil Conservation Service, have degrees in agronomy. A few soil conservationists have degrees in related fields of the natural resource sciences, such as wildlife biology, forestry, and agricultural education. Programs of study generally must include 30 semester hours in natural resources or agriculture, including at least 3 hours in soils.

A background in agricultural engineering is very helpful to soil conservationists, and courses in cartography, or mapmaking, also are helpful. Soil conservationists must be able to communicate well with people, since much of their work deals with educating farmers and ranchers in sound conservation practices. Also, they must be able to prepare written reports and plans of programs to present to farmers, range managers, and Soil and Water Conservation Districts.

Opportunities for advancement are somewhat limited. However, conservationists working at the county level may advance to the State level. Also, soil conservationists can transfer to related occupations such as farm management advisor or land appraiser. Those with advanced degrees may find teaching opportunities in colleges and universities.

Employment Outlook

Employment of soil conservationists is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to employment growth, several hundred openings will occur each year from the need to replace conservationists who die, retire, or transfer to other occupations. For example, even though employment of conservationists in the Soil Conservation Service has not increased over the past decade, the Department of Agriculture has hired, on the average, about 400 new conservationists each year.

Employment growth will occur in banks, public utilities, and other organizations that make loans on agricultural lands or that have large holdings of farm or ranch lands. Many of these organizations are adding conservationists to their staffs to help preserve the value of farmlands on which they hold mortgages or to help them comply with recent conservation and anti-pollution laws. In addition, as concern for the environment and interest in conserving the productivity of agricultural lands increases, a larger number of colleges should add soil conservation majors to their degree programs, which would increase the demand for soil conservationists to fill teaching positions. However, because this is a very attractive job choice for many people, competition for jobs as soil conservationists may make it difficult to find jobs in this field.

Earnings and Working Conditions

Soil conservationists who had a bachelor's degree and were employed by the Federal Government received $9,303 a year in 1977. Advancement to $11,523 could be expected after 1 year of satisfactory service. Those who had outstanding records in college, or who had a master's degree, started at $11,523 and could advance to $14,097 after 1 year. Further advancement depends upon the individual's ability to accept greater responsibility. Earnings of well-qualified Federal soil conservationists with several years' experience range from $17,056 to $28,725 a year.

Because soil conservationists do most of their work in the field, this may be an ideal career for a person who enjoys working outdoors. Usually during periods of bad weather they work in their offices, but occasionally they have to work outdoors in inclement weather.

Sources of Additonal Information

Additional information on employment as a soil conservationist may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; Employment Division, Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250; or any office of the Department's Soil Conservation Service.

ENGINEERS

The work of engineers affects our lives in thousands of different ways. Their past accomplishments have enabled us to drive safer automobiles, reach the moon, and even prolong life through special machinery. Future accomplishments could help us increase energy supplies, develop more pollution-free powerplants, and aid medical science's fight against disease.

In 1976, more than 1.1 million persons were employed as engineers, the second largest professional occupation, exceeded only by teachers. Most engineers specialize in one of the more than 25 specialties recognized by professional societies. Within the major branches are over 85 minor subdivisions. Structural, environmental, hydraulic, and highway engineering, for example, are subdivisions of civil engineering. Engineers also may specialize in the engineering problems of one industry, such as motor vehicles, or in a particular field of technology, such as propulsion or guidance systems. This section, which contains an overall discussion of engineering, is followed by separate statements on 12 branches of the profession—aerospace, agricultural, biomedical, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, mining, and petroleum engineering.

Nature of the Work

Engineers apply the theories and principles of science and mathematics to practical technical problems. Often their work is the link between a scientific discovery and its useful application. Engineers design machinery, products, systems, and processes for efficient and economical performance. They develop electric power, water supply, and waste disposal systems to meet the problems of urban living. They design industrial machinery and equipment used to manufacture goods; and heating, air-conditioning, and ventilation equipment for more comfortable living. Engineers also develop scientific equipment to probe outer space and the ocean depths, design defense and weapons systems for the Armed Forces, and design, plan, and supervise the construction of buildings, highways, and rapid transit systems. They design and develop consumer products such as automobiles, television sets, and refrigerators, and systems for control and automation of manufacturing, business, and management processes.

Engineers must consider many factors in developing a new product. For example, in developing new devices to reduce automobile exhaust emissions, engineers must determine the general way the device will work, design and test all components, and fit them together in an integrated plan. They must then evaluate the overall effectiveness of the new device, as well as its cost and reliability. These factors apply to most products, including those as different as medical equipment, electronic computers, and industrial machinery.

In addition to design and development, many engineers work in testing, production, operation, or maintenance. They supervise the operation of production processes, determine the causes of breakdowns, and perform tests on newly manufactured products to ensure that quality standards are maintained. They also estimate the time needed to complete engineering projects and their cost. Still others are in administrative and management jobs where an engineering background is necessary, or in sales where they discuss the technical aspects of a product and assist in planning its installation or use. (See statement on manufacturers' salesworkers elsewhere in the *Handbook*.) Engineers with considerable education or experience sometimes work as consultants. Some with advanced degrees teach in the engineering schools of colleges and universities.

Engineers within each of the branches may apply their specialized knowledge to many fields. Electrical engineers, for example, work in medicine, computers, missile guidance, or electric power distribution. Because engineering problems are usually complex, the work in some fields cuts across the traditional branches. Using a team approach to solve problems, engineers in one field often work closely with specialists in other scientific, engineering, and business occupations.

Places of Employment

More than half of all engineers work in manufacturing industries—mostly in the electrical and electronic equipment, aircraft and parts, machinery, chemicals, scientific instruments, primary metals, fabricated metal products, and motor vehicle industries. Over 340,000 were employed in nonmanufacturing industries in 1976, primarily in construction, public utilities, engineering and architectural services, and business and management consulting services.

Federal, State, and local governments employed about 150,000 engineers. Over half of these worked for the Federal Government, mainly in the Departments of Defense, Interior, Agriculture, Transportation, and in the National Aeronautics and Space Administration. Most engineers in State and local government agencies worked in highway and public works departments.

Colleges and universities employed about 45,000 engineers in research and teaching jobs, and a small number worked for nonprofit research organizations.

Engineers are employed in every State, in small and large cities and in rural areas. Some branches of engineering are concentrated in particular industries and geographic areas,

as discussed in the statements later in this chapter.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering is the generally accepted educational requirement for beginning engineering jobs. College graduates trained in one of the natural sciences or mathematics also may qualify for some beginning jobs. Experienced technicians with some engineering education are occasionally able to advance to some types of engineering jobs.

Many colleges recently have established 2- or 4-year programs leading to degrees in engineering technology. These programs prepare students for practical design and production work rather than for jobs that require more theoretical scientific and mathematical knowledge. Graduates of 4-year engineering technology programs may get jobs similar to those obtained by engineering bachelor's degree graduates. However, the status of those with the engineering technology degree is still not clear. Some employers regard them as having skills somewhere between those of a technician and an engineer.

Graduate training is being emphasized for an increasing number of jobs; it is essential for most beginning teaching and research positions, and is desirable for advancement. Some specialties, such as nuclear engineering, are taught mainly at the graduate level.

About 250 colleges and universities offer a bachelor's degree in engineering, and over 50 colleges offer a bachelor's degree in engineering technology. Although programs in the larger branches of engineering are offered in most of these institutions, some small specialties are taught in only a very few. Therefore, students desiring specialized training should investigate curriculums before selecting a college. Admissions requirements for undergraduate engineering schools usually include high school courses in advanced mathematics and the physical sciences.

In a typical 4-year curriculum, the first 2 years are spent studying basic sciences—mathematics, physics, chemistry, introductory engineering—and the humanities, social sciences, and English. The 3ast 2 years are devoted, for the most part, to specialized engineering courses. Some programs offer a general engineering curriculum, permitting the student to choose a specialty in graduate school or acquire it on the job.

Some engineering curriculums require more than 4 years to complete. A number of colleges and universities now offer 5-year master's degree programs. In addition, several engineering schools have formal arrangements with liberal arts colleges whereby a student spends 3 years in a liberal arts college studying pre-engineering subjects and 2 years in an engineering school and receives a bachelor's degree from each.

Some schools have 5- or even 6-year cooperative plans where students coordinate classroom study and practical work experience. In addition to gaining useful experience, students can finance part of their education. Because of the need to keep up with rapid advances in technology, engineers often continue their education throughout their careers.

All 50 States and the District of Columbia require licensing for engineers whose work may affect life, health, or property, or who offer their services to the public. In 1976, there were over 300,000 registered engineers. Generally, registration requirements include a degree from an accredited engineering school, 4 years of relevant work experience, and the passing of a State examination.

Engineering graduates usually begin work under the supervision of experienced engineers. Some companies have special programs to acquaint new engineers with special industrial practices and to determine the specialties for which they are best suited. Experienced engineers may advance to positions of greater responsibility and some engineers move to management or administrative positions after several years of engineering. Some engineers obtain graduate degrees in business administration to improve their advancement opportunities, while still others obtain law degrees and become patent attorneys. Many high level executives in private industry began their careers as engineers.

Engineers should be able to work as part of a team and should have creativity, an analytical mind, and a capacity for detail. They should be able to express their ideas well orally and in writing.

Employment Outlook

Employment opportunities for engineers are expected to be good through the mid-1980's in most specialities. In addition there may be some opportunities for college graduates from related fields in certain engineering jobs.

Employment requirements for engineers are expected to grow slightly faster than the average for all occupations through the mid-1980's. Much of this growth will stem from industrial expansion to meet the demand for more goods and services. More engineers will be needed in the design and construction of factories, utility systems, office buildings, and transportation systems, as well as in the development and manufacture of defense-related products, scientific instruments, industrial machinery, chemical products, and motor vehicles.

Engineers will be required in energy-related activities developing sources of energy as well as designing energy-saving systems for automobiles, homes, and other buildings. Engineers also will be needed to solve environmental problems.

The level of expenditures in some of these areas, particularly defense, however, has fluctuated in the past, affecting the requirements for engineers, and may do so in the future. The outlook for engineers given here is based on the assumption that defense spending will increase from its 1976 level but will still be lower than the peak levels of the 1960's. If, however, defense activity is higher or lower than the level assumed, the demand for engineers will be higher or

lower than now expected. Further, if the demand for their specialty declines, engineers may lose their jobs. This can be a particular problem for older engineers, who may face difficulties in finding other engineering jobs. These difficulties can be minimized by selection of a career in one of the more stable industries and engineering specialties, and by continuing education to keep up on the latest technological developments.

Despite these problems, over the long run the number of people seeking jobs as engineers is expected to be in balance with the number of job openings.

(The outlook for various branches is discussed in the separate statements later in this section.)

Earnings and Working Conditions

According to the College Placement Council, engineering graduates with a bachelor's degree and no experience were offered average starting salaries of $14,800 a year in private industry in 1976; those with a master's degree and no experience, almost $16,500 a year; and those with a Ph. D., over $21,000. Starting offers for those with the bachelor's degree vary by branch as shown in the accompanying table.

Starting salaries for engineers, by branch, 1976

Branch	Average starting salaries
Aeronautical engineering	$14,268
Chemical engineering	16,212
Civil engineering	13,764
Electrical engineering	14,448
Industrial engineering	14,568
Mechanical engineering	14,964
Metallurgical engineering	15,600

In the Federal Government in 1977, engineers with a bachelor's degree and no experience could start at $9,303 or $11,523 a year, depending on their college records. Those with a master's degree could start at $11,523 or $14,097. Those having a Ph. D. degree could begin at $17,056 or $20,442. The average salary for experienced engineers in the Federal Government was about $25,900 in 1977.

For a 9-month academic college year in 1976, faculty members with 5 years' experience beyond the bachelor's degree received about $15,150; those with 18 to 20 years experience beyond the bachelor's degree received about $21,150. (See statement on college and university teachers elsewhere in the *Handbook*.)

Engineers can expect an increase in earnings as they gain experience. According to an Engineering Manpower Commission survey, the average salary for engineers with 20 years of experience was $26,000 in 1976. Some in management positions had much higher earnings.

Many engineers work indoors in offices and research laboratories. Others, however, spend time in more active work—in a factory or mine, at a construction site, or some other outdoor location.

Sources of Additional Information

General information on engineering careers—including engineering school requirements, courses of study, and salaries—is available from:

Engineers' Council for Professional Development, 345 E. 47th St., New York, N.Y. 10017.

Engineering Manpower Commission of Engineers Joint Council, 345 E. 47th St., New York, N.Y. 10017.

National Society of Professional Engineers, 2029 K St. NW., Washington, D.C. 20006.

For information about graduate study, contact:

American Society for Engineering Education, One Dupont Circle, Suite 400, Washington, D.C. 20036.

Societies representing the individual branches of the engineering profession are listed later in this chapter. Each can provide information about careers in the particular branch. Many other engineering organizations are listed in the following publications available in most libraries or from the publisher:

Directory of Engineering Societies, published by Engineers Joint Council, 345 E. 47th St., New York, N.Y. 10017.

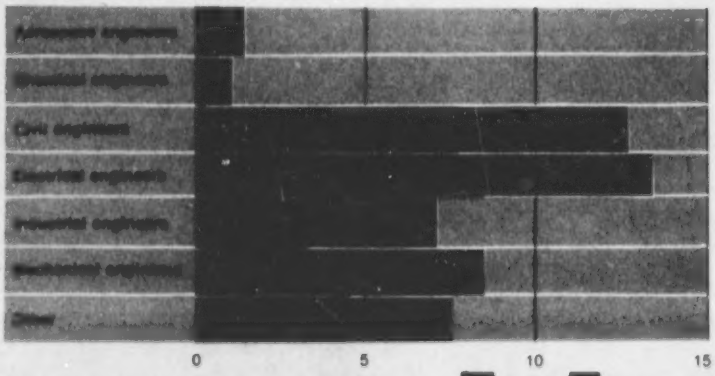
Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council, 2101 Constitution Ave., NW., Washington, D.C. 20418.

Some engineers are members of labor unions. Information on engineering unions is available from:

International Federation of Professional and Technical Engineers, 1126 16th St. NW., Washington, D.C. 20036.

Growth and replacement needs are expected to provide many job openings for engineers

Selected engineering occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

AEROSPACE ENGINEERS

(D.O.T. 002.081)

Nature of the Work

Aerospace engineers design, develop, test, and help produce commercial and military aircraft, missiles, and spacecraft. They play an important role in advancing the state of technology in commercial aviation, defense systems, and space exploration.

Aerospace engineers often specialize in an area of work like structural design, navigational guidance and control, instrumentation and communication, or production methods. They also may specialize in one type of aerospace product such as passenger planes, helicopters, satellites, or rockets.

Places of Employment

About 50,000 aerospace engineers were employed in 1976, mainly in the aircraft and parts industry. Some worked for Federal Government agencies, primarily the National Aeronautics and Space Administration and the Department of Defense. A few worked for commercial airlines, consulting firms, and colleges and universities.

Employment Outlook

Employment of aerospace engineers is expected to grow more slowly than the average for all occupations through the mid-1980's. Employment of aerospace engineers is largely determined by the level of Federal expenditures on defense and space programs: in the past, rapid changes in spending levels have usually been accompanied by sharp employment fluctuations. Expenditures for the space program are expected to increase only slightly from 1976 to the mid-1980's, while defense spending will probably increase moderately. Although few jobs will be created by employment growth, many workers will be required to fill openings created by deaths, retirements, and transfers of workers to other occupations. (See introductory section of this chapter for discussion of training requirements and earnings. See also statement on aircraft, missile, and spacecraft manufacturing elsewhere in the *Handbook*.)

Aerospace engineer checking out part of a spacecraft.

Sources of Additional Information

American Institute of Aeronautics and Astronautics, Inc., 1290 Avenue of the Americas, New York, N.Y. 10019.

AGRICULTURAL ENGINEERS

(D.O.T. 013.081)

Nature of the Work

Agricultural engineers design machinery and equipment, and develop methods to improve efficiency in the production, processing, and distribution of food and other agricultural products. They also are concerned with the conservation and management of energy, soil, and water resources. Agricultural engineers work in research and development, production, sales, or management.

Places of Employment

Most of the 12,000 agricultural engineers employed in 1976 worked for manufacturers of farm equipment, electric utility companies, and distributors of farm equipment and supplies. Some worked for engineering consultants who supply services to farmers and farm-related industries; others were independent consultants.

About 450 agricultural engineers are employed in the Federal Government, mostly in the Department of

Agriculture; some are employed in colleges and universitites; and a few work in State and local governments.

Employment Outlook

Employment of agricultural engineers is expected to grow faster than the average for all occupations through the mid-1980's. Increasing demand for agricultural products, modernization of farm operations, increasing emphasis on conservation of resources, and the use of agricultural products and wastes as industrial raw materials should provide additional opportunities for engineers. (See introductory part of this section for information on training requirements and earnings. See also statement on agriculture elsewhere in the *Handbook*.)

Sources of Additional Information

American Society of Agricultural Engineers, 2950 Niles Rd., St. Joseph, Mich. 49085.

BIOMEDICAL ENGINEERS

Nature of the Work

Biomedical engineers use engineering principles to solve medical and health-related problems. Many do research, along with life scientists, chemists, and members of the medical profession, on the engineering aspects of the biological systems of man and animals. Some design and develop medical instruments and devices including artificial hearts and kidneys, lasers for surgery, and pacemakers that regulate the heartbeat. Other biomedical engineers adapt computers to medical science, and design and build systems to modernize laboratory, hospital, and clinical procedures. Most engineers in this field require a sound background in one of the major engineering disciplines (mechanical, electrical, industrial, or chemical) in addition to specialized biomedical training.

Many biomedical engineers are involved in research.

Places of Employment

There were about 3,000 biomedical engineers in 1976. Most teach and do research in colleges and universities. Some work for the Federal Government, primarily in the National Aeronautics and Space Administration, or in State agencies. An increasing number work in private industry developing new devices, techniques, and systems for improving health care. Some work in sales positions.

Employment Outlook

Employment of biomedical engineers is expected to grow faster than the average for all occupations through the mid-1980's, but the actual number of openings is not likely to be very large. Those who have advanced degrees will be in demand to teach and to fill jobs resulting from increased expenditures for medical research. Increased research funds could also create new positions in instrumentation and systems for the delivery of health services. (See introductory part of this chapter for information on training requirements and earnings.)

Sources of Additional Information

Alliance for Engineering in Medicine and Biology, Suite 404, 4405 East-West Highway, Bethesda, Md. 20014.

Biomedical Engineering Society, P.O. Box 2399, Culver City, Calif. 90230.

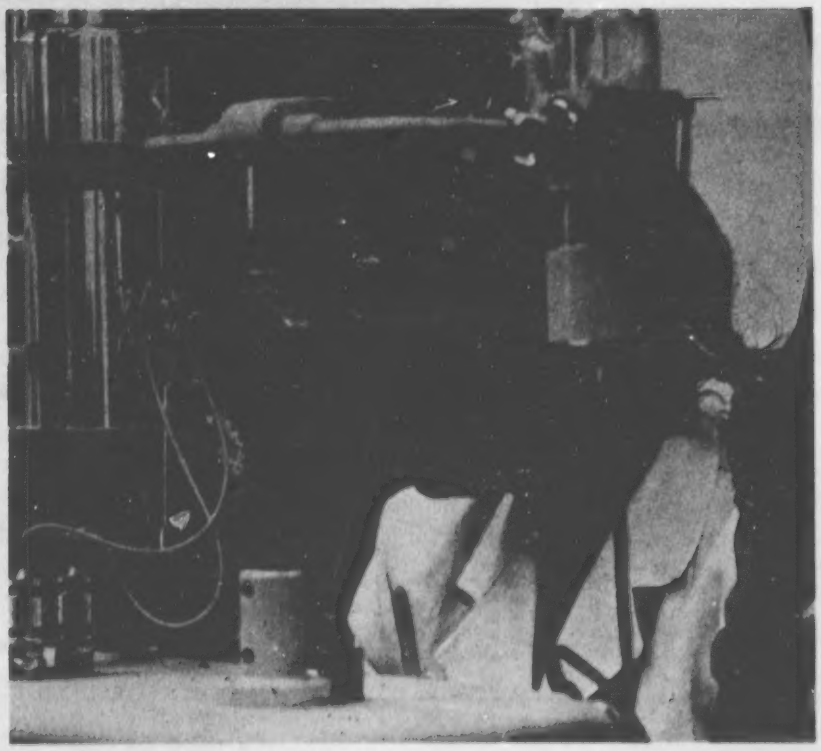
CERAMIC ENGINEERS

(D.O.T. 006.081)

Nature of the Work

Ceramic engineers develop new ceramic materials and methods for making ceramic materials into useful products. Although to some, the word ceramics means pottery, ceramics actually include all nonmetallic, inorganic materials which require the use of high temperature in their processing. Thus, ceramic engineers work on diverse products such as glassware, heat-resistant materials for furnaces, electronic components, and nuclear reactors. They also design and supervise the construction of plants and equipment to manufacture these products.

Ceramic engineers generally specialize in one product or more—for



Most ceramic engineers are employed in the stone, clay, and glass industry.

example, products of refractories (fire-and heat-resistant materials such as firebrick); whitewares (porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile and terra cotta); electronic ceramics (ferrites for memory systems and microwave devices); protective and refractory coatings for metals; glass; abrasives; cement technology; or fuel elements for atomic energy.

Places of Employment

About 12,000 ceramic engineers were employed in 1976, mostly in the stone, clay, and glass industry. Others work in industries that produce or use ceramic products such as the iron and steel, electrical equipment, aerospace, and chemicals industries. Some are in colleges and universities, independent research organizations, and the Federal Government.

Employment Outlook

Employment of ceramic engineers is expected to grow faster than the average for all occupations through the mid-1980's. Programs related to nuclear energy, electronics, defense, and medical science will provide job opportunities for ceramic engineers. Additional ceramic engineers will be required to improve and adapt traditional ceramic products, such as whitewares and abrasives, to new uses. The development of filters and catalytic surfaces to reduce pollution, and the development of ceramic materials for energy conversion and conservation, should create additional openings for ceramic engineers. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Ceramic Society, 65 Ceramic Dr., Columbus, Ohio 43214.

CHEMICAL ENGINEERS

(D.O.T. 008.081)

Nature of the Work

Chemical engineers are involved in many phases of the production of chemicals and chemical products. They design equipment and chemical plants as well as determine methods of manufacturing the product. Often, they design and operate pilot plants to test their work and develop chemical processes such as those to remove chemical contaminants from waste materials. Because the duties of chemical engineers cut across many fields, these professionals must have a working knowledge of chemistry, physics, and mechanical and electrical engineering.

This branch of engineering is so diversified and complex that chemical engineers frequently specialize in a particular operation such as oxidation or polymerization. Others specialize in a particular area such as pollution control or in the production of a specific product like plastics or rubber.

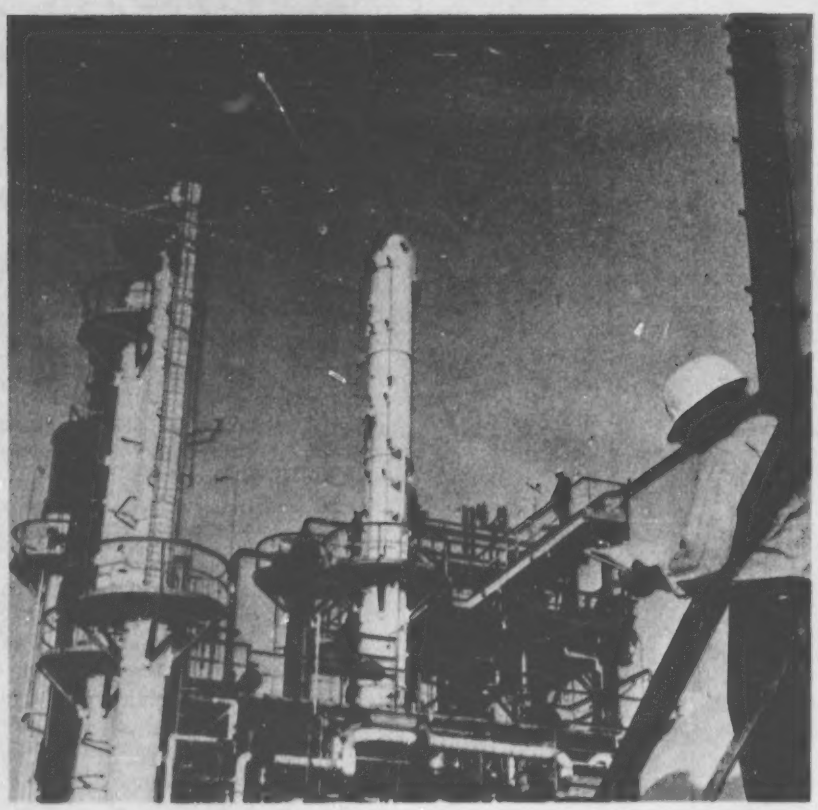
Places of Employment

Most of the 50,000 chemical engineers working in 1976 were in manufacturing industries, primarily those producing chemicals, petroleum, and related products. Some worked in government agencies or taught and did research in colleges and universities. A small number worked for independent research institutes and engineering consulting firms, or as independent consulting engineers.

Employment Outlook

Employment of chemical engineers is expected to grow about as fast as the average for all occupations through the mid-1980's. A major factor underlying this growth is industry expansion—the chemicals industry in particular.

The growing complexity and automation of chemical processes will require additional chemical engineers



Chemical engineer checks production instructions at chemical plant.

to design, build, and maintain the necessary plants and equipment. Chemical engineers also will be needed to solve problems dealing with environmental protection, development of synthetic fuels, and the design and development of nuclear reactors. In addition, development of new chemicals used in the manufacture of consumer goods, such as plastics and synthetic fibers, probably will create additional openings. (See introductory part of this section for information on training requirements and earnings. See also the statement on chemists and the industrial chemical industry elsewhere in the *Handbook*.)

Sources of Additional Information

American Institute of Chemical Engineers, 345 East 47th St., New York, N.Y. 10017.

CIVIL ENGINEERS

(D.O.T. 005.081)

Nature of the Work

Civil engineers, who work in the oldest branch of the engineering profession, design and supervise the construction of roads, harbors, airports, tunnels, bridges, water supply and sewage systems, and buildings. Major specialties within civil engineering are structural, hydraulic, environmental (sanitary), transportation (including highways and railways), geotechnical, and soil mechanics.

Many civil engineers are in supervisory or administrative positions ranging from supervisor of a construction site to city engineer to top-level executive. Others teach in colleges and universities or work as consultants.

Places of Employment

About 155,000 civil engineers were employed in 1976. Most work for Federal, State, and local government agencies or in the construction industry. Many work for consulting engineering and architectural firms or as independent consulting engineers. Others work for public utilities, railroads, educational institutions, and manufacturing industries.

Civil engineers work in all parts of the country, usually in or near major industrial and commercial centers. They often work at construction sites, sometimes in remote areas or in foreign countries. In some jobs, they must often move from place to place to work on different projects.

Employment Outlook

Employment of civil engineers is expected to increase about as fast as the average for all occupations through the mid-1980's. Job opportunities will result from the growing needs for housing, industrial buildings, electric power generating plants, and transportation systems created by a growing population and an expanding economy. Work related to solving problems of environmental pollution and energy self-sufficiency will also require additional civil engineers.

Many civil engineers also will be needed each year to replace those who retire, die, or transfer to other occupations. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Society of Civil Engineers, 345 E. 47th St., New York, N.Y. 10017.

ELECTRICAL ENGINEERS

(D.O.T. 003.081, .151, and .187)

Nature of the Work

Electrical engineers design, develop, test, and supervise the manufacture of electrical and electronic equipment. Electric equipment in-

Most civil engineers work for construction companies and Federal, State, and local governments.

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cludes power generating and transmission equipment used by electric motors, machinery controls, and lighting and wiring in buildings, and in automobiles and aircraft. Electronic equipment includes radar, computers, communications equipment, missile guidance systems, and consumer goods such as televisions and stereos.

Electrical engineers generally specialize in a major area—such as integrated circuits, computers, electrical equipment manufacturing, communications, or power distributing equipment—or in a subdivision of these areas—microwave communication or aviation electronic systems, for example. Electrical engineers design new products and specify their uses and write performance requirements and maintenance schedules. They also test equipment, solve operating problems, and estimate the time and cost of engineering projects. Besides employment in research, development, and design, many are in manufacturing, administration and management, technical sales, or college teaching.

Places of Employment

Electrical engineering is the largest branch of the profession. About 300,000 electrical engineers were employed in 1976, mainly by manufacturers of electrical and electronic equipment, aircraft and parts, business machines, and professional and scientific equipment. Many work for telephone, telegraph, and electric light and power companies. Large numbers are employed by government agencies and by colleges and universities. Others work for construction firms, for engineering consultants, or as independent consulting engineers.

Employment Outlook

Employment of electrical engineers is expected to increase about as fast as average for all occupations through the mid-1980's. Although increased demand for computers, communications, and military electronics

Electrical engineer developing specialized electrical equipment.

is expected to be the major contributor to this growth, demand for electrical and electronic consumer goods, along with increased research and development in new types of power generation, should create additional jobs. Many electrical engineers also will be needed to replace personnel who retire, die, or transfer to other fields of work.

The long-range outlook for electrical engineers is based on the assumption that defense spending in the mid-1980's will increase from the 1976 level, but will still be somewhat lower than the peak level of the late 1960's. If defense activity is higher or lower than the projected level, the demand for electrical engineers will be higher or lower than now expected.

(See introductory part of this section for information on training requirements and earnings. See also statement on electronics manufacturing elsewhere in the *Handbook*.)

Sources of Additional Information

Institute of Electrical and Electronic Engineers/United States Activities Board, 2029 K St., N.W., Washington, D.C. 20006.

INDUSTRIAL ENGINEERS

(D.O.T. 012.081, .168, and .188)

Nature of the Work

Industrial engineers determine the most effective ways for an organization to use the basic factors of production—people, machines, and materials. They are more concerned with people and methods of business organization than are engineers in other specialties who generally are concerned more with particular products or processes, such as metals, power, or mechanics.

To solve organizational, production, and related problems most efficiently, industrial engineers design data processing systems and apply mathematical concepts (operations research techniques). They also develop management control systems to aid in financial planning and cost analysis, design production planning and control systems to coordinate activities and control product quality, and design or improve systems for the physical distribution of goods and services. Industrial engineers also conduct plant location surveys, where they look for the best combination of sources of raw materials, transportation, and taxes, and develop wage and salary administration systems and job evaluation programs. Because the work is closely related, many industrial engineers move into management positions.

Places of Employment

About 200,000 industrial engineers were employed in 1976; more than two-thirds worked in manufacturing industries. Because their skills can be used in almost any type of company, they are more widely distributed among industries than are those in other branches of engineering. For example, some work for insurance companies, banks, construction and mining firms, and public utilities. Hospitals, retail organizations, and other large business firms employ industrial engineers to improve operating efficiency. Still others work for government agencies and colleges and universities. A few are independent consulting engineers.

Employment Outlook

Employment of industrial engineers is expected to grow faster than the average for all occupations through the mid-1980's. The increasing complexity of industrial operations and the expansion of automated processes, along with industry growth, are factors contributing to employment growth. Increased recognition of the importance of scientific management and safety engineering in reducing costs and increasing productivity, and the need to solve environmental problems, should create additional opportunities.

Additional numbers of industrial engineers will be required each year to replace those who retire, die, or transfer to other occupations. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

American Institute of Industrial Engineers, Inc., 25 Technology Park/Atlanta, Norcross, Ga. 30092.

Industrial engineer reviewing film of production process to check for problems.

MECHANICAL ENGINEERS

(D.O.T. 007.081, .151, .168, and .187)

Nature of the Work

Mechanical engineers are concerned with the production, transmission, and use of power. They design and develop power-producing machines such as internal combustion engines, steam and gas turbines, and jet and rocket engines. They also design and develop power-using machines such as refrigeration and air-conditioning equipment, elevators, machine tools, printing presses, and steel rolling mills.

The work of mechanical engineers varies by industry and function since many specialties have developed within the field. Specialties included are motor vehicles, marine equipment, energy conversion systems, heating, ventilating and air-conditioning, instrumentation, and machines for specialized industries, such as petroleum, rubber and plastics, and construction.

Large numbers of mechanical engineers do research, test, and design work. Many are administrators or managers, while others work in maintenance, technical sales, and production operations. Some teach in colleges and universities or work as consultants.

Places of Employment

About 200,000 mechanical engineers were employed in 1976. Almost three-fourths were employed in manufacturing—mainly in the primary and fabricated metals, machinery, transportation equipment, and electrical equipment industries. Others worked for government agencies, educational institutions, and consulting engineering firms.

Employment Outlook

Employment of mechanical engineers is expected to increase about as fast as the average for all occupations through the mid-1980's. The growing demand for industrial machinery and machine tools and the increasing complexity of industrial machinery and processes will be major factors supporting increased employment opportunities. Mechanical engineers will be needed to develop new energy systems and to help solve environmental pollution problems.

Large numbers of mechanical engineers also will be required each year to replace those who retire, die, or transfer to other occupations. (See introductory part of this section for information on training requirements and earnings. See also statement on occupations in the atomic energy field elsewhere in the *Handbook*.)

Sources of Additional Information

The American Society of Mechanical Engineers, 345 E. 47th St., New York, N.Y. 10017.

METALLURGICAL ENGINEERS

(D.O.T. 011.081)

Nature of the Work

Metallurgical engineers develop methods to process and convert metals into useful products. Most of these engineers generally work in one of the three main branches of metallurgy—extractive or chemical, physical, and mechanical. Extractive metallurgists are concerned with extracting metals from ores, and refining and alloying them to obtain useful metal. Physical metallurgists deal with the nature, structure, and physical properties of metals and their alloys, and with methods of converting refined metals into final products. Mechanical metallurgists develop methods to work and shape metals

Metallurgical engineers study the physical properties of metal.

such as casting, forging, rolling, and drawing. Scientists working in this field are known as metallurgists or materials scientists, but the distinction between scientists and engineers in this field is small.

Places of Employment

The metalworking industries—primarily the iron and steel and nonferrous metals industries—employed over one-half of the estimated 17,000 metallurgical and materials engineers in 1976. Metallurgical engineers also work in industries that manufacture machinery, electrical equipment, and aircraft and parts, and in the mining industry. Some work for government agencies and colleges and universities.

Employment Outlook

Employment of metallurgical and materials engineers is expected to grow faster than the average for all occupations through the mid-1980's. An increasing number of these engineers will be needed by the metalworking industries to develop new metals and alloys as well as to adapt current ones to new needs. For example, communications equipment, computers, and spacecraft require lightweight metals of high purity. As the supply of high-grade ores diminishes, more metallurgical engineers will be required to develop new ways of recycling solid waste materials in addition to processing low-grade ores now regarded as unprofitable to mine. Metallurgical engineers also will be needed to solve problems associated with the efficient use of nuclear energy. (See introductory part of this section for information on training requirements and earnings. Also see statement on the iron and steel industry elsewhere in the *Handbook*.)

Sources of Additional Information

The Metallurgical Society of the American Institute of Mining, Metallurgical, and Petroleum Engineers, 345 E. 47th St., New York, N.Y. 10017.

American Society for Metals, Metals Park, Ohio 44073.

MINING ENGINEERS

(D.O.T. 010.081 and .187)

Nature of the Work

Mining engineers find, extract, and prepare minerals for manufacturing industries to use. They design the layouts of open pit and underground mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Mining engineers are responsible for the economic and efficient operation of mines and mine safety, including ventilation, water supply, power, communications, and equipment maintenance. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment or direct mineral processing operations, which involve separating minerals from the dirt, rocks, and other materials they are mixed with. Mining engineers frequently specialize in the mining of one specific mineral such as coal or copper.

With increased emphasis on protecting the environment, many mining engineers have been working to solve problems related to mined-land reclamation and water and air pollution.

Places of Employment

About 6,000 mining engineers were employed in 1976. Most work in the mining industry. Some work for firms that produce equipment for the mining industry, while others work in colleges and universities, in government agencies, or as independent consultants.

Mining engineers are usually employed at the location of mineral deposits, often near small communities. However, those in research, teaching, management, consulting, or sales often are located in large metropolitan areas.

Employment Outlook

Employment of mining engineers is expected to increase faster than

Mining engineers are responsible for the efficient operation of mines and mine safety.

the average for all occupations through the mid-1980's. Efforts to attain energy self-sufficiency should spur the demand for coal, and therefore for mining engineers in the coal industry. The increase in demand for coal will depend, to a great extent, on the availability and price of other domestic energy sources such as petroleum, natural gas, and nuclear energy. More technologically advanced mining systems and further enforcement of mine health and safety regulations also will increase the need for mining engineers. In addition, exploration for all other minerals is also increasing. Easily mined deposits are being depleted, creating a need for engineers to devise more efficient methods for mining low-grade ores. Employment opportunities also will arise as new alloys and new uses for metals increase the demand for less widely used ores. Recovery of metals from the sea and the development of oil shale deposits could present major challenges to the mining engineer. (See introductory part of this section for information on training requirements and earnings. See also statement on mining elsewhere in the *Handbook*.)

Sources of Additional Information

The Society of Mining Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers, 540 Arapeen Dr.—Research Park, Salt Lake City, Utah 84108.

PETROLEUM ENGINEERS

(D.O.T. 010.081)

Nature of the Work

Petroleum engineers are mainly involved in exploring and drilling for and producing oil and gas. They work to achieve the maximum profitable recovery of oil and gas from a petroleum reservoir by determining and developing the best and most efficient production methods.

Since only a small proportion of the oil and gas in a reservoir will flow out under natural forces, petroleum engineers develop and use various artificial recovery methods such as flooding the oil field with water to force the oil to the surface. Even when using the best recovery methods, about half the oil is still left in the ground. Petroleum engineers' research and development efforts to increase the proportion of oil recovered in each reservoir can make a significant contribution to increasing available energy resources.

Places of Employment

About 20,000 petroleum engineers were employed in 1976, mostly in the petroleum industry and closely allied fields. Their employers include not only the major oil companies, but also the hundreds of smaller independent oil exploration and production companies. They also work for companies that produce drilling equipment and supplies. Some petroleum engineers work in banks and other financial institutions which need their knowledge of the economic value of oil and gas properties. A small number work for engineering consulting firms or as independent consulting engineers, and for the Federal and State governments.

The petroleum engineer's work is concentrated in places where oil and gas are found. Almost three-fourths of all petroleum engineers are employed in the oil-producing States of Texas, Oklahoma, Louisiana, and California. There are many American petroleum engineers working overseas in oil-producing countries.

Petroleum engineers discuss problem with drilling supervisor.

Employment Outlook

The employment of petroleum engineers is expected to grow faster than the average for all occupations through the mid-1980's. Economic expansion will require increasing supplies of petroleum and natural gas, even with energy conservation measures. With efforts to attain energy self-sufficiency, and high petroleum prices, increasingly sophisticated and expensive recovery methods will be used. Also, new sources of oil such as oil shale and new offshore oil sources may be developed. All of these factors will contribute to increasing demand for petroleum engineers. (See introductory part of this section for information on training requirements and earnings.)

Sources of Additional Information

Society of Petroleum Engineers of AIME, 6200 North Central Expressway, Dallas, Tex. 75206.

ENVIRONMENTAL SCIENTISTS

Environmental scientists help us understand our natural environment—the earth, its atmosphere, and the oceans. These scientists, sometimes known as earth scientists, are concerned with the history, composition, and characteristics of the earth's surface, interior, and atmosphere. Some do basic research to increase scientific knowledge, while others do applied research, using knowledge gained from basic research to help solve practical problems. Geologists, for example, may explore for new sources of oil and other minerals, while many meteorologists forecast the weather. Environmental scientists also play an important role in solving environmental pollution problems. Many environmental scientists teach in colleges and universities.

This chapter discusses four environmental science occupations—geologists, geophysicists, meteorologists, and oceanographers.

GEOLOGISTS

(D.O.T. 024.081)

Nature of the Work

Geologists study the structure, composition, and history of the earth's crust. By examining surface rocks and drilling to recover rock cores, they determine the types and distribution of rocks beneath the earth's surface. They also identify rocks and minerals, conduct geological surveys, draw maps, take measurements, and record data. Geological research helps to determine the structure and history of the earth and may result in significant advances such as the ability to predict earthquakes. An important application of geologists' work is locating oil and other minerals.

Geologists use many tools and instruments such as hammers, chisels, levels, transits (mounted telescopes used to measure angles), gravity meters, cameras, compasses, and seismographs (instruments that record the intensity and duration of earthquakes and earth tremors). They may evaluate information from photographs taken from aircraft and satellites and use computers to record and analyze data.

Geologists also examine chemical and physical properties of specimens in laboratories under controlled temperature and pressure. They may study fossil remains of animal and vegetable life or experiment with the flow of water and oil through rocks. Laboratory equipment used by geologists includes complex instruments such as the X-ray diffractometer, which determines the structure of minerals, and the petrographic microscope, used for close study of rock formations.

Besides locating resources and working in laboratories, geologists also are called on to advise construction companies and governmental agencies on the suitability of certain locations for constructing buildings, dams, or highways. Some geologists administer and manage research and exploration programs. Others teach and work on research projects in colleges and universities.

Geologists usually specialize in one or a combination of three general areas—earth materials, earth processes, and earth history.

Economic geologists locate earth materials such as minerals and solid fuels. *Petroleum geologists* search for and recover oil and natural gas. Some petroleum geologists work near drilling sites and others corre-

Geologist examining surface rocks.

late petroleum related geologic information for entire regions. *Engineering geologists* determine suitable sites for the construction of roads, airfields, tunnels, dams, and other structures. They decide, for example, whether underground rocks will bear the weight of a building or whether a proposed structure may be in an earthquake-prone area. *Mineralogists* analyze and classify minerals and precious stones according to composition and structure. *Geochemists* study the chemical composition and changes in minerals and rocks to understand the distribution and migration of elements in the earth's crust.

Geologists concerned with earth processes study land forms and their rock masses, sedimentary deposits (matter deposited by water or wind) and eruptive forces such as volcanoes. *Volcanologists* study active and inactive volcanoes, and lava flows and other eruptive activity. *Geomorphologists* examine landforms and those forces, such as erosion and glaciation, which cause them to change.

Other geologists are primarily concerned with earth history. *Paleontologists* study plant and animal fossils to trace the evolution and development of past life. *Geochronologists* determine the age of rocks and land forms by the radioactive decay of their elements. *Stratigraphers* study the distribution and arrangement of sedimentary rock layers by examining their fossil and mineral content.

Many geologists specialize in new fields that require knowledge of another science as well. *Astrogeologists* study geological conditions on other planets. *Geological oceanographers* study the sedimentary and other rock on the ocean floor and continental shelf. (See statements on oceanographers and mining elsewhere in the *Handbook*.)

Places of Employment

More than 34,000 people worked as geologists in 1976. More than three-fifths of all geologists work in private industry. Most industrial geologists work for petroleum companies. Geologists also work for mining and quarrying companies. (See statements on the mining and petroleum industries elsewhere in the *Handbook*.) Some are employed by construction firms. Others are independent consultants to industry and government.

The Federal Government employs over 2,000 geologists. Two-thirds work for the Department of the Interior in the U.S. Geological Survey, the Bureau of Mines, and the Bureau of Reclamation. State agencies also employ geologists, some working on surveys in cooperation with the U.S. Geological Survey.

Colleges and universities employ about 9,500 geologists. Some work for nonprofit research institutions and museums.

Employment of geologists is concentrated in those States with large oil and mineral deposits. Almost two-thirds work in five States: Texas, California, Louisiana, Colorado, and Oklahoma. Some are employed by American firms overseas for varying periods of time.

Training, Other Qualifications, and Advancement

A bachelor's degree in geology or a related field is adequate for entry into some geology jobs. An advanced degree is helpful for promotion in most types of work, and is essential for college teaching and many research positions.

About 300 colleges and universities offer a bachelor's degree in geology. Undergraduate students devote about one-fourth of their time to geology courses, including physical, structural and historical geology, mineralogy, petrology, and invertebrate paleontology, about one-third of their time taking mathematics, related sciences—such as physics and chemistry—and engineering; and the remainder on general academic subjects.

More than 160 universities award advanced degrees in geology. Graduate students take advanced courses in geology and specialize in one branch of the science.

Students planning careers in exploration geology should like the outdoors, and must have physical stamina.

Geologists usually begin their careers in field exploration or as research assistants in laboratories. With experience, they can be promoted to project leader, program manager, or other management and research positions.

Employment Outlook

Employment opportunities in geology are expected to be good for those with degrees in geology or in a related science with courses in geology. The employment of geologists is expected to grow faster than the average for all occupations through the mid-1980's. This growth will create many new openings each year. Many additional openings will be created each year by geologists who retire, die, or leave the occupation.

Increased prices for petroleum and the necessity to locate new sources of other minerals as older sources become exhausted will stimulate domestic exploration activities and require many additional geologists. Additional geologists also will be needed to discover new resources and their potential uses. For example, geologists will help determine the feasibility of using geothermal energy (steam from the earth's interior) to generate electricity. Geologists are needed to devise techniques for exploring deeper within the earth's crust and to develop more efficient methods of mining resources. They also are needed to develop adequate water supplies and waste disposal methods, and to do site evaluation for construction activities.

Earnings and Working Conditions

Geologists have relatively high salaries, with average earnings over twice those of nonsupervisory workers in private industry, except farming.

According to a survey done by the College Placement Council, in early 1977 graduates with bachelor's degrees in other physical and earth sciences received average starting offers of $13,300 a year. Graduates

with master's degrees in geology and related geological sciences received average starting offers of $14,900 per year.

In the Federal Government in 1977, geologists having a bachelor's degree could begin at $9,303 or $11,523 a year, depending on their college records. Those having a master's degree could start at $11,523 or $14,097 a year; those having the Ph. D. degree at $17,056 or $20,442. In 1977, the average salary for geologists employed in the Federal Government was over $25,000 a year.

Conditions of work vary. Exploration geologists often work overseas. Geologists travel to remote sites by helicopter and jeep, and cover large areas by foot, often working in teams. Geologists in mining sometimes work underground. When not working outdoors, they are in comfortable, well-lighted, well-ventilated offices and laboratories.

Sources of Additional Information

General information on training and career opportunities for geologists is available from:

American Geological Institute, 5205 Leesburg Pike, Falls Church, Va. 22041.

For information on Federal Government careers, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

GEOPHYSICISTS

(D.O.T. 024.081)

Nature of the Work

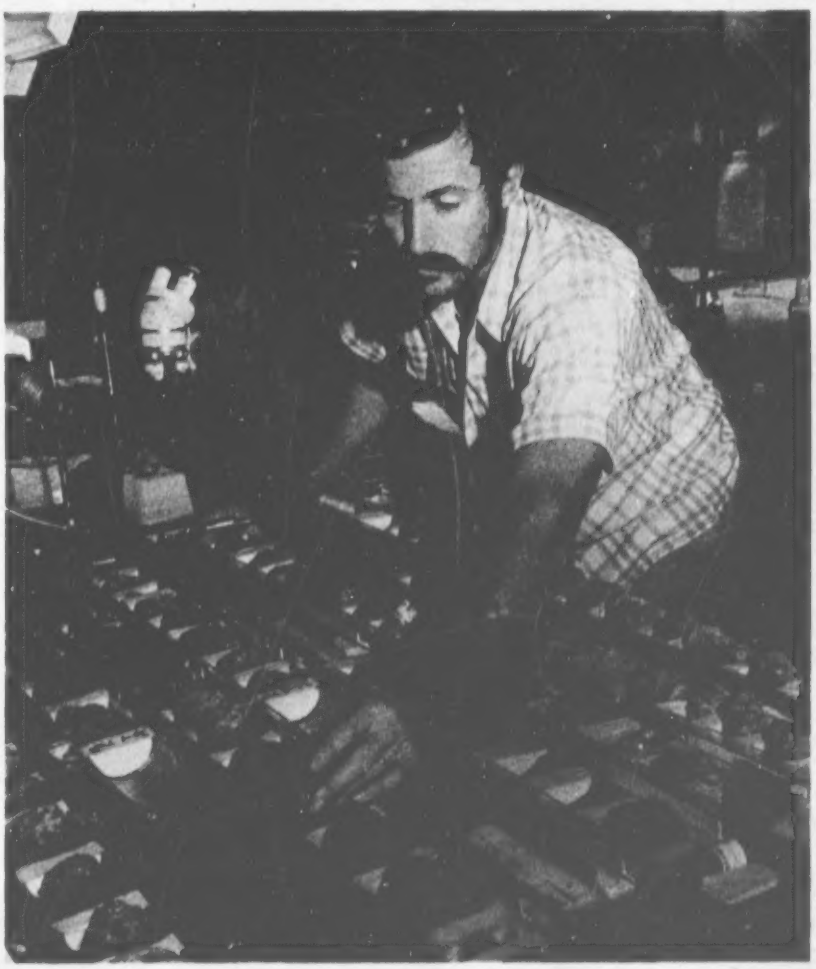
Geophysicists study the composition and physical aspects of the earth and its electric, magnetic, and gravitational fields. Geophysicists use highly complex instruments such as the magnetometer which measures variations in the earth's magnetic field, and the gravimeter which measures minute variations in gravitational attraction. They often use satellites to conduct tests from outer space and computers to collect and analyze data.

Geophysicists usually specialize in 1 of 3 general phases of the science—solid earth, fluid earth, and upper atmosphere. Some may also study other planets.

Solid earth geophysicists search for oil and mineral deposits, map the earth's surface, and study earthquakes. *Exploration geophysicists* use seismic prospecting techniques to locate oil and mineral deposits. They send sound waves into the earth and record the echoes bouncing off the rock layers below to determine if conditions are favorable for the accumulation of oil.

Seismologists study the earth's interior and earth vibrations caused by earthquakes and manmade explosions. They explore for oil and minerals, study underground detection of nuclear explosions, and provide information for use in constructing bridges, dams, and buildings. For example, in constructing a dam, seismologists determine where bedrock (solid rock beneath the soil) is closest to the surface so the best dam site can be selected. They use explosives or other methods to create sound waves that reflect off bedrock; the time it takes for the shock wave to return to the surface indicates the depth of bedrock. Seismologists also seek to understand the causes of earthquakes so that one day they might be predicted.

Geodesists study the size, shape, and gravitational field of the earth and other planets. Their principal task is precise measurement of the earth's surface. With the aid of satellites, geodesists determine the positions, elevations, and distances be-



Some geophysicists work in research laboratories.

tween points on the earth, and measure the intensity and direction of gravitational attraction.

Hydrologists are concerned with the fluid earth. They may study the distribution, circulation, and physical properties of underground and surface waters, including glaciers, snow, and permafrost. They also may study rainfall and its rate of infiltration into soil. Some are concerned with water supplies, irrigation, flood control, and soil erosion. (See statement on oceanographers, sometimes classified as geophysical scientists, elsewhere in the *Handbook*.)

Geophysicists also study the atmosphere, investigate the earth's magnetic and electric fields, and compare its outer atmosphere with those of other planets. *Geomagneticians* study the earth's magnetic field. *Paleomagneticians* learn about past magnetic fields from rocks or lava flows. *Planetologists* study the composition and atmosphere of the moon, planets, and other bodies in the solar system. They gather data from geophysical instruments placed on interplanetary space probes or from equipment used by astronauts during the Apollo missions. *Meteorologists* sometimes are classified as geophysical scientists. (See statement on meteorologists elsewhere in the *Handbook*.)

Places of Employment

About 12,000 people worked as geophysicists in 1976. Most work in private industry, chiefly for petroleum and natural gas companies. (See statement on the mining and petroleum industry elsewhere in the *Handbook*.) Others are in mining companies, exploration and consulting firms, and research institutes. A few are independent consultants and some do geophysical prospecting on a fee or contract basis.

Geophysicists are employed in many southwestern and western States, and in those on the Gulf Coast, where large oil and natural gas fields are located. Some geophysicists are employed by American firms overseas for varying periods of time.

Almost 2,300 geophysicists, geodesists, and hydrologists worked for Federal Government agencies in 1976, mainly the U.S. Geological Survey; the National Oceanic and Atmospheric Administration (NOAA); and the Defense Department. Other geophysicists work for colleges and universities, State governments, and nonprofit research institutions.

Training, Other Qualifications, and Advancement

A bachelor's degree in geophysics or a geophysical specialty is sufficient for most beginning jobs in geophysics. A bachelor's degree in a related field of science or engineering also is adequate preparation, provided the person has courses in geophysics, physics, geology, mathematics, chemistry, and engineering.

Geophysicists doing research or supervising exploration activities should have graduate training in geophysics or a related science. Those planning to teach in colleges or do basic research should acquire a Ph. D. degree.

About 50 colleges and universities award the bachelor's degree in geophysics. Other programs offering training for beginning geophysicists include geophysical technology, geophysical engineering, engineering geology, petroleum geology, and geodesy.

More than 60 universities grant the master's and Ph. D. degree in geophysics. Candidates with a bachelor's degree which includes courses in geology, mathematics, physics, engineering, or a combination of these subjects can be admitted.

Geophysicists often work as part of a team. They should be curious, analytical, and able to communicate effectively.

Most new geophysicists begin their careers doing field mapping or exploration. Some assist senior geophysicists in research laboratories. With experience, geophysicists can advance to jobs such as project leader or program manager, or other management and research jobs.

Employment Outlook

Employment opportunities are expected to be very good for graduates with a degree in geophysics or a related field, though few openings are expected. Nevertheless, the number of people qualified to enter the field may fall short of requirements if present trends in the number obtaining geophysics training continue.

Employment of geophysicists is expected to grow faster than the average for all occupations through the mid-1980's. As known deposits of petroleum and other minerals are depleted, petroleum and mining companies over the next decade will need increasing numbers of geophysicists who can use sophisticated electronic techniques to find less acessible fuel and mineral deposits.

In addition, geophysicists with advanced training will be needed to do research on radioactivity and cosmic and solar radiation and to investigate the use of geothermal power (steam from the earth's interior) as a source of energy to generate electricity.

Federal agencies are expected to hire more geophysicists for new and expanding programs. Through the mid-1980's, jobs will depend heavily on funds for research and development in earth sciences as the Government supports energy research in both established and alternative sources. The Government also may fund research to locate more natural resources and to prevent environmental damage through better land use.

Earnings and Working Conditions

Geophysicists have relatively high salaries, with average earnings more than twice those of nonsupervisory workers in private industry, except farming.

According to a survey done by the College Placement Council, in early 1977 graduates with bachelor's degrees in other physical and earth sciences received average starting offers of $13,300 a year. Graduates with master's degrees in geology and related geological sciences received average starting offers of $14,900 per year.

In the Federal Government in 1977, geophysicists having a bachelor's degree could begin at $9,303 or $11,523 a year, depending on their college records. Geophysicists having a master's degree could start at $11,523 or $14,841 a year; those having a Ph. D. degree, at $17,056 or $20,442. In 1977, the average salary for geophysicists employed by the Federal Government was about $24,500 a year.

Many geophysicists work outdoors and must be willing to travel for extended periods of time. Some work at research stations in remote areas, or aboard ships and aircraft equipped with sophisticated geophysical equipment. When not in the field, geophysicists work in modern, well-equipped, well-lighted laboratories and offices.

Sources of Additional Information

General information on career opportunities, training, and earnings for geophysicists is available from:

American Geophysical Union, 1909 K St. NW., Washington, D.C. 20006.

Society of Exploration Geophysicists, P.O. Box 3098, Tulsa, Okla. 74101.

For information on Federal Government careers, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St., NW., Washington, D.C. 20415.

METEOROLOGISTS

(D.O.T. 025.088)

Nature of the Work

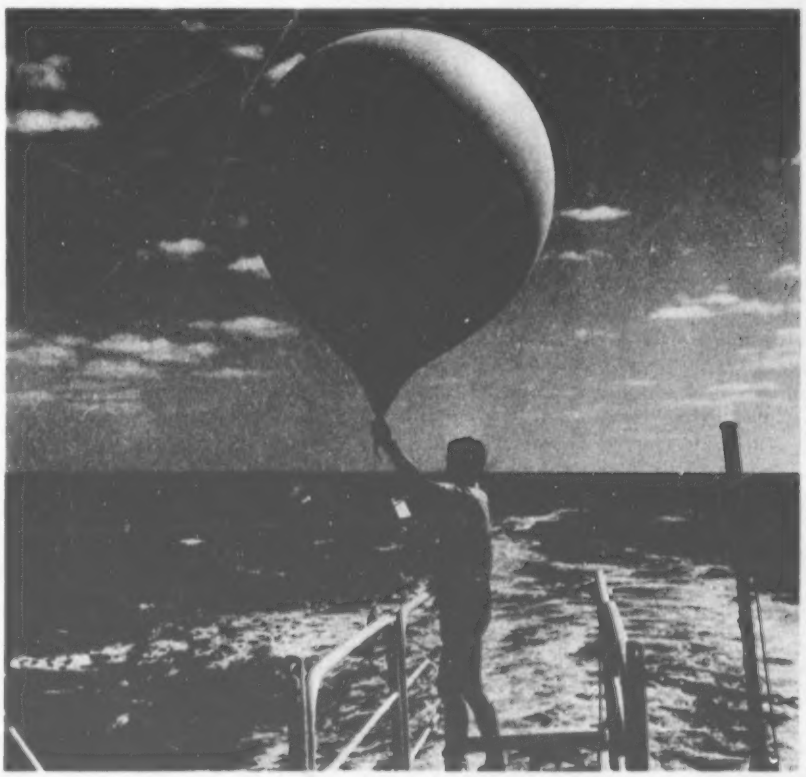
Meteorology is the study of the atmosphere, which is the air that surrounds the earth. Meteorologists describe and try to understand the atmosphere's physical characteristics, motions, and processes, and determine the way the behavior of the atmosphere affects the rest of our physical environment. The best known application of this knowledge is in understanding and forecasting the weather. Meteorological research is also applied in many other areas not directly related to weather forecasting such as understanding and solving air pollution problems and studying trends in the earth's climate.

Meteorologists who specialize in forecasting the weather, known professionally as *synoptic meteorologists*, are the largest group of specialists. They study current weather information, such as air pressure, temperature, humidity, and wind velocity, in order to make short-range and long-range predictions. Their data come from weather satellites and observers in many parts of the world. Although some forecasters still prepare and analyze weather maps, most data now are plotted and analyzed by computers.

Some meteorologists are engaged in basic and applied research. For example, *physical meteorologists* study the chemical and electrical properties of the atmosphere. They do research on the effect of the atmosphere on transmission of light, sound, and radio waves, as well as study factors affecting formation of clouds, rain, snow, and other weather phenomena. Other meteorologists, known as *climatologists*, study climatic trends and analyze past records on wind, rainfall, sunshine, and temperature to determine the general pattern of weather that makes up an area's climate. These studies are useful in planning heating and cooling systems, designing buildings, and aiding in effective land utilization.

Other meteorologists apply their knowledge in the study of the relationship between weather and specific human activities, biological processes, and agricultural and industrial operations. For example, they may make weather forecasts for individual companies, or may work on problems such as smoke control and air pollution abatement.

About one-third of all civilian meteorologists work primarily in weather forecasting, and another one-third work in research and development. Almost one-fifth of all civilian me-



Meteorologist sending weather balloon aloft.

teorologists are in administrative or management positions.

Some meteorologists teach or do research—frequently combining both activities—in colleges and universities. In colleges without separate departments of meteorology, they may teach geography, mathematics, physics, chemistry, or geology, as well as meteorology.

Places of Employment

About 5,500 persons worked as meteorologists in 1976. In addition to these civilian meteorologists, thousands of members of the Armed Forces did forecasting and other meteorological work.

The largest employer of civilian meteorologists was the National Oceanic and Atmospheric Administration (NOAA), where over 1,800 worked at stations in all parts of the United States and in a small number of foreign areas. The Department of Defense employed over 200 civilian meteorologists.

Almost 2,000 meteorologists worked for private industry. Commercial airlines employed several hundred to forecast weather along flight routes and to brief pilots on atmospheric conditions. Others worked for private weather consulting firms, for companies that design and manufacture meteorological instruments, and for firms in aerospace, insurance, engineering, utilities, radio and television, and other industries.

Colleges and universities employed over 1,300 meteorologists in research and teaching. A few worked for State and local governments and for nonprofit organizations.

Although meteorologists work in all parts of the country, nearly one-fifth live in just two States—California and Maryland. Almost one-tenth of all meteorologists work in the Washington, D.C. area.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in meteorology is the usual minimum requirement for beginning jobs in weather forecasting. However, a bachelor's degree in a related science or engineering, along with some courses in meteorology, is acceptable for some jobs. For example, the Federal Government's minimum requirement for beginning jobs is a bachelor's degree with at least 20 semester hours of study in meteorology and courses in physics and mathematics, including calculus. However, employers prefer to hire those with an advanced degree, and an advanced degree is increasingly necessary for advancement.

For research and college teaching and for many top-level positions in other meteorological activities, an advanced degree, preferably in meteorology, is essential. However, people with graduate degrees in other sciences also may qualify if they have advanced courses in meteorology, physics, mathematics, and chemistry.

In 1976, 44 colleges and universities offered a bachelor's degree in meteorology or atmospheric science; 59 schools offered advanced degrees. Many other institutions offered some courses in meteorology.

The Armed Services give and support meteorological training, both undergraduate education for enlisted personnel and advanced study for officers.

NOAA has a program under which some of its meteorologists attend college for advanced or specialized training. College students can obtain summer jobs with this agency or enroll in its cooperative education program in which they work at NOAA part of the year and attend school part of the year. In addition to helping students finance their education, this program gives them experience valuable for finding a job when they graduate.

Beginning meteorologists often start in jobs involving routine data collection, computation, or analysis. Experienced meteorologists may advance in academic rank or to various supervisory or administrative jobs. A few very well qualified meteorologists with a background in science, engineering, and business administration may establish their own weather consulting services.

Employment Outlook

Job opportunities for meteorologists should be favorable through the mid-1980's. Although the number of openings created by growth in the occupation and replacement needs is not expected to be large, the number of persons obtaining degrees in meteorology also is small. If trends in the number of degrees granted continue, the number of people seeking entry to the field will about equal requirements.

Employment in the field, as a whole, is expected to increase about as fast as the average for all occupations. Employment of meteorologists in industry and in weather consulting firms is expected to grow as private industry realizes the importance of meteorology to understanding and preventing air pollution. Many companies are also recognizing the value of having their own weather forecasting and meteorological services which can be tailored to fit their needs. There also should be some openings in radio and television as stations increasingly rely on their own meteorologists to prepare and deliver their weather reports. Colleges and universities will offer some job opportunities, especially for those with advanced degrees. The employment of civilian meteorologists by the Federal Government is not expected to grow significantly, although there will be openings created by replacement needs.

Earnings and Working Conditions

Meteorologists have relatively high earnings; their salaries are about twice the average for nonsupervisory workers in private industry, except farming.

In 1977, meteorologists in the Federal Government with a bachelor's degree and no experience received starting salaries of $9,303 or $11,523 a year, depending on their college grades. Those with a master's degree could start at $11,523 or $14,097, and those with the Ph. D. degree at $17,056 or $20,442. The average salary for meteorologists employed by

the Federal Government was $24,500 in 1977.

Airline meteorologists' salaries ranged from about $16,000 to $24,000 a year in 1976, depending on experience. (See Statement on Occupations in Civil Aviation elsewhere in the *Handbook*.)

Jobs in weather stations, which are operated around the clock 7 days a week, often involve nightwork and rotating shifts. Most stations are at airports or in or near cities; some are in isolated and remote areas. Meteorologists in smaller weather stations generally work alone; in larger ones, they work as part of a team.

Sources of Additional Information

General information on career opportunities in meteorology is available from:

American Meteorological Society, 45 Beacon St., Boston, Mass. 02108.

American Geophysical Union, 1909 K St. NW., Washington, D.C. 20006.

For facts about job opportunities with the NOAA National Weather Service and its student cooperative education program, contact:

Personnel Operations Branch, AD 41, National Oceanic and Atmospheric Administration, 6001 Executive Blvd., Rockville, Md. 20852.

OCEANOGRAPHERS

(D.O.T. 024.081 and 041.081)

Nature of the Work

Oceans cover more than two-thirds of the earth's surface and are a source of valuable foods, fossil fuels, and minerals. They also influence the weather, serve as a "highway" for transportation, and offer many kinds of recreation. Oceanographers use the principles and techniques of natural science, mathematics, and engineering to study oceans—their movements, physical properties, and plant and animal life. Their research not only extends basic scientific knowledge, but also helps develop practical methods for forecasting weather, developing fisheries, mining ocean resources, and improving national defense.

Most oceanographers test their ideas about the ocean by making observations and conducting experiments at sea. They may study and collect data on ocean tides, currents, and other phenomena. They may study undersea mountain ranges and valleys, oceanic interactions with the atmosphere, and layers of sediment on and beneath the ocean floor.

Many oceanographers work primarily in laboratories on land where, for example, they measure, dissect, and photograph fish. They also study sea specimens and plankton (floating microscopic plants and animals). Much of their work entails identifying, cataloging, and analyzing different kinds of sea life and minerals. At other laboratories, oceanographers plot maps or use computers to test theories about the ocean. For example, they may study and test the theory of continental drift, which states that the continents were once joined together, have drifted to new positions, and continue to drift, causing the sea floor to spread in places. To present the results of their studies, oceanographers prepare charts, tabulations, and reports, and write papers for scientific journals.

Oceanographers explore and study the ocean with surface ships, aircraft, and various types of underwater craft. They use specialized instruments to measure and record the findings of their explorations and studies. Special cameras equipped with strong lights are used to photograph marine life and the ocean floor. Sounding devices are used to measure, map, and locate ocean materials.

Most oceanographers specialize in one branch of the science. *Biological oceanographers* (marine biologists) study plant and animal life in the ocean. The biological oceanographer's research has practical applications in improving and controlling commercial and sport fishing and in determining the effects of pollution on marine life. *Physical oceanographers* (physicists and geophysicists) study the physical properties of the ocean. Their research on the relationships between the sea and the atmosphere may lead to more accurate prediction of the weather. *Geological oceanographers* (marine geologists) study the ocean's underwater mountain ranges, rocks, and sediments. Locating regions where minerals, oil, and gas might be found under the ocean floor is an application of their work. *Chemical oceanographers* investigate the chemical composition of ocean water and sediments as well as chemical reactions in the sea. *Oceanographic engineers* and *electronic specialists* design and build instruments for oceanographic research and operations. They also lay cables and supervise underwater construction.

Many other scientists also work on problems related to oceans, but are counted in other scientific fields such as biology, chemistry, or geology.

Places of Employment

About 2,700 persons worked as oceanographers in 1976. About one-half worked in colleges and universities, and more than one-fourth for the Federal Government. Federal agencies employing substantial numbers of oceanographers include the Navy and the National Oceanic and Atmospheric Administration (NOAA). Some oceanographers work in private industry; a few work for fishery laboratories of State and local governments.

Most oceanographers work in States that border on the ocean, although there are some oceanographers employed in almost every State. Four out of 10 oceanographers work in just three States—California, Maryland, and Virginia.

Training, Other Qualifications, and Advancement

The minimum requirement for beginning professional jobs in oceanography is a bachelor's degree with a major in oceanography, biology, earth or physical sciences, mathematics, or engineering. However, most jobs in research, teaching, and high-level positions in most other types of oceanographic work require graduate training in oceanography or

Four out of ten oceanographers work in just three States—California, Maryland, and Virginia.

a basic science, and a doctoral degree is often preferred or required for many oceanography positions.

About 35 colleges and universities offered undergraduate degrees in oceanography or marine sciences in 1976. However, undergraduate training in a basic science and a strong interest in oceanography may be adequate preparation for some beginning jobs and is the preferred background for graduate training in oceanography.

College courses needed to prepare for graduate study in oceanography include mathematics, physics, chemistry, geophysics, geology, meteorology, and biology. In general, students should specialize in the particular science that is closest to their area of oceanographic interest. For example, students interested in chemical oceanography could obtain a degree in chemistry.

In 1976, about 65 colleges offered advanced degrees in oceanography and marine sciences. In graduate schools, students take advanced courses in oceanography and in basic sciences.

Graduate students usually work part of the time aboard ship, where they do oceanographic research and become familiar with the sea and with techniques used to obtain oceanographic information. Universities having oceanographic research facilities along our coasts offer summer courses for both graduate and undergraduate students. Oceanographers should have the curiosity needed to do research and the patience to collect data and conduct experiments.

Beginning oceanographers with the bachelor's degree usually start as research or laboratory assistants, or in jobs involving routine data collection, computation, or analysis. Most beginning oceanographers receive on-the-job training. The extent of the training varies with the background and needs of the individual.

Experienced oceanographers often direct surveys and research programs or advance to administrative or supervisory jobs in research laboratories.

Employment Outlook

Persons seeking jobs in oceanography may face competition through the mid-1980's. Those with a Ph. D. degree should have more favorable employment opportunities than others, while those with less education may find opportunities limited to routine analytical work as research assistants or technicians. Persons who combine knowledge of other scientific or engineering fields with oceanographic studies should have better employment prospects than others whose knowledge is limited to oceanography.

Employment of oceanographers is expected to grow about as fast as the average for all occupations. This growth will result from increased awareness of the need for ocean research for understanding and controlling pollution, for recovering offshore oil and other natural resources, and for national defense. However, growth in employment may not be rapid enough to create enough openings for all those expected to seek entry into this relatively small field. Since the Federal Government finances most oceanographic research, a large increase in Federal spending in oceanography could improve employment prospects.

Earnings and Working Conditions

Oceanographers have relatively high earnings. Their average salaries were more than twice the average received by nonsupervisory workers in private industry, except farming.

In 1977, oceanographers in the Federal Government with a bachelor's degree received starting salaries of $9,303 or $11,523 a year, depending on their college grades. Those with a master's degree could start at $11,523 or $14,097; and those with a Ph. D. degree at $17,056 or $20,442. The average salary for experienced oceanographers in the Federal Government in 1977 was about $23,800 a year.

Oceanographers in educational institutions generally receive the same salaries as other faculty members. (See statement on College and University Teachers elsewhere in the *Handbook*.) In addition to regular salaries, many earn extra income from consulting, lecturing, and writing.

Oceanographers engaged in research that requires sea voyages are frequently away from home for weeks or months at a time. Sometimes they live and work in cramped quarters. People who like the sea and oceanographic research often find these voyages satisfying and do not consider the time spent at sea a disadvantage of their work.

Sources of Additional Information

For information about careers in oceanography, contact:

Dr. C. Schelske, Secretary, American Society of Limnology and Oceanography, Great Lakes Research Division, University of Michigan, Ann Arbor, Mich. 48109.

Federal Government career information is available from any regional office of the U.S. Civil Service Commission or from:

U.S. Civil Service Commission, Washington Area Office, 1900 E St. NW., Washington, D.C. 20415.

The booklet, *Training and Careers in Marine Science*, is available for fifty cents from:

International Oceanographic Foundation, 3979 Rickenbacker Causeway, Virginia Key, Miami, Fla. 33149.

Some information on oceanographic specialties is available from professional societies listed elsewhere in the *Handbook*. (See statements on Geologists, Geophysicists, Life Scientists, Meteorologists, and Chemists.)

LIFE SCIENCE OCCUPATIONS

Life scientists study living organisms and their life processes. They are concerned with the origin and preservation of life, from the largest animal to the smallest living cell. The number and variety of plants and animals is so large, and their processes so varied and complex, that life scientists usually work in one of the three broad areas—agriculture, biology, or medicine.

Life scientists teach, perform basic research to expand knowledge of living things, and apply knowledge gained from research to the solution of practical problems. New drugs, special varieties of plants, and a cleaner environment result from the work of life scientists.

This chapter discusses life scientists as a group. It also contains separate statements on biochemists and soil scientists.

BIOCHEMISTS

(D.O.T. 041.081)

Nature of the Work

Biochemists study the chemical composition and behavior of living things. Since life is based on complex chemical combinations and reactions, the work of biochemists is vital for an understanding of reproduction, growth, and heredity. Biochemists also may study the effects of food, hormones, or drugs on various organisms.

The methods and techniques of biochemistry are applied in areas such as medicine, nutrition, and agriculture. For instance, biochemists may investigate causes and cures for diseases, identify the nutrients necessary to maintain good health, or develop chemical compounds for pest control.

More than 3 out of 4 biochemists work in basic and applied research activities. The distinction between basic and applied research is often one of degree and biochemists may do both types. Most, however, are in basic research. The few doing strictly applied research use the results of basic research to solve practical problems. For example, knowledge of how an organism forms a hormone is used to synthesize and produce hormones on a mass scale.

Laboratory research involves weighing, filtering, distilling, drying, and culturing (growing microorganisms). Some experiments also require the designing and constructing of laboratory apparatus or the use of radioactive tracers. Biochemists use a variety of instruments, including electron microscopes and centrifuges, and they may devise new instruments and techniques as needed.

Many biochemists work in basic and applied research activities.

They usually report the results of their research in scientific journals or before scientific groups.

Some biochemists combine research with teaching in colleges and universities. A few work in industrial production and testing activities.

Places of Employment

About 12,700 biochemists were employed in the United States in 1976. About one-half are employed in colleges and universities; over one-fourth work in private industry, primarily in companies manufacturing drugs, insecticides, and cosmetics; some work for nonprofit research institutes and foundations; and others for Federal, State, and local government agencies. Most government biochemists do health and agricultural research for Federal agencies. A few self-employed biochemists are consultants to industry and government.

Training, Other Qualifications, and Advancement

The minimum educational requirement for many beginning jobs as a biochemist, especially in research or teaching, is an advanced degree. A Ph. D. degree is a virtual necessity for persons who hope to contribute significantly to biochemical research and advance to many management and administrative jobs. A bachelor's degree with a major in biochemistry or chemistry, or with a major in biology and a minor in chemistry, may qualify some persons for entry jobs as research assistants or technicians.

More than 100 schools award the bachelor's degree in biochemistry, and nearly all colleges and universities offer a major in biology or chemistry. Persons planning careers as biochemists should take undergraduate courses in chemistry, biology, biochemistry, mathematics, and physics.

About 150 colleges and universities offer graduate degrees in biochemistry. Graduate students generally are required to have a bachelor's degree in biochemistry, biology, or chemistry. Many graduate programs emphasize one specialty in biochem-

istry because of the facilities or the research being done at that particular school. Graduate training requires actual research in addition to advanced science courses so students should select their schools carefully. For the doctoral degree, the student does intensive research and a thesis in one field of biochemistry.

Persons planning careers as biochemists should be able to work independently or as part of a team. Precision, keen powers of observation, and mechanical aptitude also are important. Biochemists should have analytical abilities and curious minds, as well as patience and perseverance to complete hundreds of experiments necessary to solve a single problem. They should also express themselves clearly when writing and speaking to communicate the findings of their research effectively.

Graduates with advanced degrees may begin their careers as teachers or researchers in colleges or universities. In private industry, most begin in research jobs and with experience may advance to positions in which they plan and supervise research.

New graduates with a bachelor's degree usually start work as research assistants or technicians. These jobs in private industry often involve testing and analysis. In the drug industry, for example, research assistants analyze the ingredients of a product to verify and maintain its purity or quality.

Employment Outlook

Job opportunities for biochemists with advanced degrees should be favorable through the mid-1980's. The employment of biochemists is expected to grow about as fast as the average for all occupations during this period. Some additional job openings will result each year as biochemists retire, die, or transfer to other occupations. The outlook for biochemists is based on the assumption that research and development expenditures in biochemistry and related sciences, primarily by the Federal Government, will increase through the mid-1980's, although at a slower rate than during the 1960's. If actual expenditures differ significantly from those assumed, the outlook for biochemists would be altered.

The anticipated growth in this field should result from the effort to find cures for cancer, heart disease, and other diseases, and from public concern with environmental protection. Biochemists will also be needed in the drug and other industries and in hospitals and health centers. Colleges and universities may need additional teachers as biochemistry enrollments continue to increase.

Earnings and Working Conditions

Average earnings of biochemists were about twice the average for all nonsupervisory workers in private industry, except farming. According to a 1976 survey by the American Chemical Society, salaries for experienced biochemists averaged $18,000 for those with a bachelor's degree; $19,000 for those with a master's degree; and $26,000 for those with a Ph. D.

Starting salaries of biochemists employed in colleges and universities are comparable to those for other faculty members. (See statement on college and university teachers elsewhere in the *Handbook*.)

Biochemists in research and development do most of their work in a laboratory, but they also may write, lecture, and do library research.

Sources of Additional Information

For general information on careers in biochemistry, contact:

American Society of Biological Chemists, 9650 Rockville Pike, Bethesda, Md. 20014.

LIFE SCIENTISTS

(D.O.T. 040.081, 041.081, 041.168, 041.181, 041.281)

Nature of the Work

Life scientists, who study all aspects of living organisms, emphasize the relationship of animals and plants to their environment.

About one-third of all life scientists are primarily involved in research and development. Many conduct basic research to increase our knowledge of living organisms which can be applied in medicine, in increasing crop yields, and in improving the natural environment. When working in laboratories, life scientists must be familiar with research techniques and complex laboratory equipment such as electron microscopes. Knowledge of computers also is useful in conducting experiments. Not all research, however, is performed in laboratories. For example, a botanist who explores the volcanic Alaskan valleys to see what plants grow there also is doing research.

About one-third of all life scientists teach in colleges or universities; many also do independent research. Almost one-fifth work in management or administration ranging from planning and administering programs for testing foods and drugs to directing activities at zoos or botanical gardens. Some life scientists work as consultants to business firms or to government in their areas of specialization. Others write for technical publications or test and inspect foods, drugs, and other products. Some work in technical sales and services jobs for industrial companies where, for example, they demonstrate the proper use of new chemicals or technical products.

Scientists in many life science areas often call themselves *biologists*. However, the majority are classified by the type of organism they study or by the specific activity they perform.

Botanists deal primarily with plants and their environment. Some study all aspects of plant life, while others work in specific areas such as identifying and classifying plants or studying the structure of plants and plant cells. Other botanists concentrate on causes and cures of plant diseases.

Agronomists, who are concerned with the mass development of plants, improve the quality and yield of crops, such as corn, wheat, and cotton, by developing new growth methods or by controlling diseases, pests, and weeds. They also analyze soils to determine ways of increasing acreage yields and decreasing soil erosion.

Horticulturists work with orchard and garden plants such as fruit and nut trees, vegetables, and flowers. They seek to improve plant culture methods for the beautification of communities, homes, parks, and other areas as well as for increasing crop quality and yields.

Zoologists study various aspects of animal life—its origin, behavior, and life processes. Some conduct experimental studies with live animals in controlled or natural surroundings while others dissect animals to study the structure of their parts. Zoologists are usually identified by the animal group studied—ornithologists (birds), entomologists (insects), and mammalogists (mammals).

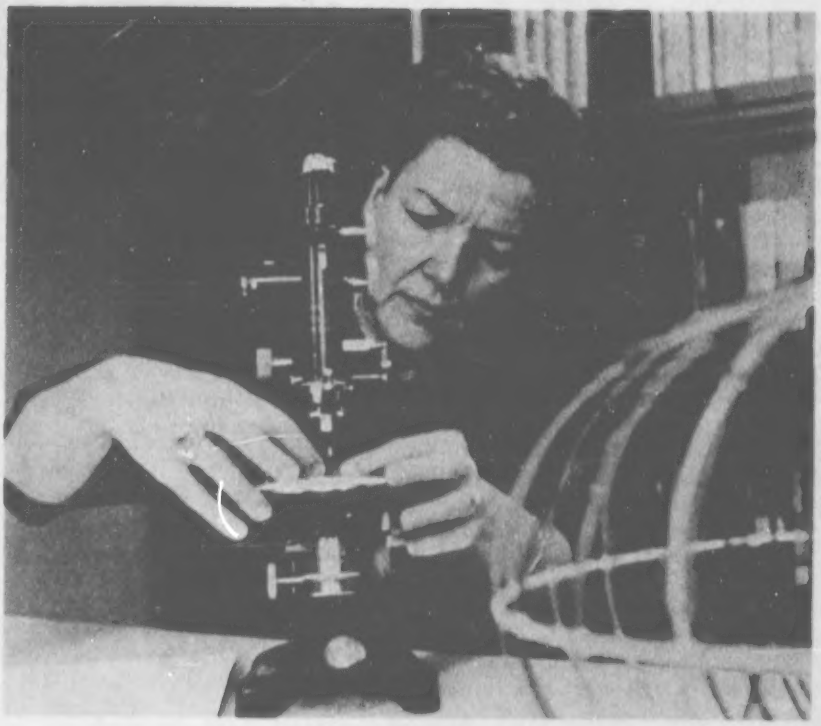
Animal husbandry specialists do research on the breeding, feeding, and diseases of domestic farm animals. *Veterinarians* study diseases and abnormal functioning in animals. (See statement on veterinarians elsewhere in the *Handbook*.)

Anatomists study the structure of organisms, from cell structure to the formation of tissues and organs. Many specialize in human anatomy. Research methods may entail dissections or the use of electron microscopes.

Some life scientists apply their specialized knowledge across a number of areas, and may be classified by the functions performed. *Ecologists*, for example, study the relationship between organisms and their environments, particularly the effects of environmental influences such as rainfall, temperature, and altitude on organisms. For example, ecologists extract samples of plankton (microscopic plants and animals) from bodies of water to determine the effects of pollution, and measure the radioactive content of fish.

Embryologists study the development of an animal from a fertilized egg through the hatching process or gestation period. They investigate the causes of healthy and abnormal development in animals.

Microbiologists are life scientists who investigate the growth and characteristics of microscopic organisms such as bacteria, viruses, and molds. They isolate and grow organisms for close examination under a microscope. *Medical microbiologists* are concerned with the relationship between bacteria and disease or the effect of antibiotics on bacteria. Other microbiologists may specialize in soil bacteriology (effect of microorganisms on soil fertility), virology (viruses), or immunology (mechanisms that fight infections).



Life scientists study living organisms and their life processes.

Nutritionists examine the bodily processes through which food is utilized and transformed into energy. They learn how vitamins, minerals, proteins, and other nutrients build and repair tissues.

Pharmacologists conduct tests on animals such as rats, guinea pigs, and monkeys to determine the effects of drugs, gases, poisons, dusts, and other substances on the functioning of tissues and organs. They may develop new or improved drugs and medicines.

Pathologists specialize in the effects of diseases, parasites, and insects on human cells, tissues, and organs. Others may investigate genetic variations caused by drugs.

Biochemists and biological oceanographers, who are also life scientists, are included in separate statements elsewhere in the *Handbook*.

Places of Employment

An estimated 205,000 persons worked as life scientists in 1976. Almost 40,000 were agricultural scientists, about 100,000 were biological scientists, and about 65,000 were medical scientists.

Colleges and universities employ nearly three-fifths of all life scientists, in both teaching and research jobs. Medical schools and hospitals also employ large numbers of medical investigators. Sizable numbers of specialists in agronomy, horticulture, animal husbandry, entomology, and related areas work for State agricultural colleges and agricultural experiment stations.

About 18,000 life scientists worked for the Federal Government in 1976. Of these, over half worked for the Department of Agriculture, with large numbers also in the Department of the Interior, and in the National Institutes of Health. State and local governments combined

employed about 22,000 life scientists.

Approximately 40,000 life scientists worked in private industry, mostly in the pharmaceutical, industrial chemical, and food processing industries in 1976. About 6,000 worked for nonprofit research organizations and foundations; a few were self-employed.

Life scientists are distributed fairly evenly throughout the United States, but employment is cencentrated in some metropolitan areas—for example, nearly 6 percent of all agricultural and biological scientists work in the Washington, D.C., metropolitan area. Life science teachers are concentrated in communities with large universities.

Training, Other Qualifications, and Advancement

Persons seeking a career in the life sciences should plan to obtain an advanced degree. The Ph. D. degree generally is required for college teaching, for independent research, and for many administrative jobs. A master's degree is sufficient for some jobs in applied research and college teaching. A health science degree is necessary for some jobs in medical research (See section on health occupations elsewhere in the *Handbook*.)

The bachelor's degree is adequate preparation for some beginning jobs, but promotions often are limited for those who hold no higher degree. New graduates with a bachelor's degree can start their careers in testing and inspecting jobs, or become technical sales and service representatives. They also may become advanced technicians, particularly in medical research or, with courses in education, a high school biology teacher. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Most colleges and universities offer life science curriculums. However, different schools may emphasize only certain areas of life science. For example, liberal arts colleges may emphasize the biological sciences, while many State universities and land-grant colleges offer programs in agricultural science.

Students seeking careers in the life sciences should obtain the broadest possible undergraduate background in biology and other sciences. Courses taken should include biology, chemistry, physics, and mathematics.

Many colleges and universities confer advanced degrees in the life sciences. Requirements for advanced degrees usually include field work and laboratory research as well as classroom studies and preparation of a thesis.

Prospective life scientists should be able to work independently or as part of a team and must be able to communicate their findings in clear and concise language, both orally and in writing. Some life scientists, such as those conducting field research in remote areas, must have good physical stamina.

Life scientists who have advanced degrees usually begin in research or teaching jobs. With experience, they may advance to jobs such as supervisors of research programs.

Employment Outlook

Employment opportunities for life scientists are expected to be good for those with advanced degrees through the mid-1980's, but those with lesser degrees may experience competition for available jobs. However, a life science degree also is useful for entry to occupations related to life science such as laboratory technology and the health care occupations. Employment in the life sciences is expected to increase faster than the average for all occupations over this period. In addition, some openings will occur as life scientists retire, die, or transfer to other occupations.

Employment in the life sciences will grow as a result of increased interest in preserving the natural environment and a continuing interest in medical research. Employment opportunities in industry and government should grow as environmental research and development increases and new laws and standards protecting the environment are enacted. Additional life science teachers will be needed if college and university enrollments increase as expected.

Earnings and Working Conditions

Life scientists receive relatively high salaries; their average earnings are more than twice those of nonsupervisory workers in private industry, except farming.

Beginning salary offers in private industry in 1976 averaged $10,900 a year for bachelor's degree recipients in agricultural science and $10,200 a year for bachelor's degree recipients in biological science.

In the Federal Government in 1977, life scientists having a bachelor's degree could begin at $9,303 or $11,523 a year, depending on their college records. Life scientists having the master's degree could start at $11,523 or $14,097, depending on their academic records or work experience. Those having the Ph. D. degree could begin at $17,056 or $20,442 a year. Agricultural and biological scientists in the Federal Government averaged $21,600 a year.

Earnings of all life scientists averaged about $20,300 a year in 1976, according to the limited data available. Life scientists who have the M.D. degree generally earn more than other life scientists but less than physicians in private practice.

Most life scientists work in well-lighted, well-ventilated, and clean laboratories. Some jobs, however, require working outdoors under extreme weather conditions, doing strenuous physical labor.

Sources of Additional Information

General information on careers in the life sciences is available from:

American Institute of Biological Sciences, 1401 Wilson Boulevard, Arlington, Va. 22209.

American Society for Horticultural Science, National Center for American Horticulture, Mt. Vernon, Va. 22121.

American Physiological Society, Education Office, 9650 Rockville Pike, Bethesda, Md. 20014.

Special information on Federal Government careers is available from:

U.S. Civil Service Commission, Washington Area Office, 1900 E St. NW., Washington, D.C. 20415.

SOIL SCIENTISTS

(D.O.T. 040.081)

Nature of the Work

Because soil is one of our most valuable resources, it must be used wisely. Soil scientists help to accomplish this by studying the physical, chemical, biological, and behavioral characteristics of soils. A large part of their job is categorizing soils according to a national classification system. To do this, a soil scientist investigates the soils at various places within an area, often taking samples to analyze in the laboratory. Once the soils in an area have been classified, the soil scientist prepares a map, usually based on aerial photographs, which shows soil types throughout the area as well as landscape features, such as streams or hills, and physical features, such as roads or property boundaries.

Because different types of soil are better suited for some uses than others, soil type maps are invaluable tools for urban and regional planners concerned with land use. A planner who may wish to locate large buildings, such as factories or apartment buildings, on a secure base would look for firm soils containing clay. In contrast, sandy soils drain much better than clays, and thus are better suited for uses that require good drainage, such as farming. In addition, a small but increasing number of States require certified soil scientists to examine soils and determine their drainage capacities before issuing building permits for lots on which residences using septic systems are to be built.

Besides the many soil scientists who are employed mapping soils, some conduct research into the chemical and biological properties of soils to determine their agricultural uses. With the assistance of agricultural technicians, they set up experiments in which they grow crops in different types of soils to determine which are most productive for certain crops. They also may test the effects of fertilizers on various types of soils to develop fertilizers adapted to particular soils and to find ways to improve less productive soils. Other soil scientists, who have backgrounds in the biological sciences, may investigate the presence of organic materials in soils and study the effects of these organisms on plant growth.

In recent years, mounting concern over the quality of water has led to research into the causes of pollution and it has been found that sediment, or soil runoff, is responsible for much of the problem. Many States, in an effort to comply with Federal antipollution laws, now employ soil scientists to inspect large highway and building sites where vegetation has been stripped away, and agricultural lands where fertilizers have been applied, to make sure proper erosion control methods have been followed.

Places of Employment

An estimated 2,500 soil scientists were employed in 1976. Soil scientists work all over the country, in every State and nearly every county. More than half were employed by the Soil Conservation Service of the U.S. Department of Agriculture. Some worked for other agencies of the Federal Government, State agricultural experiment stations, and colleges of agriculture. Others were employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State conservation departments, and farm management agencies. A few are independent consultants, and others work for consulting firms. In addition, some soil scientists worked in foreign countries as research leaders, consultants, and agricultural managers.

Training, Other Qualifications, and Advancement

Training in a college or university is important in obtaining employment as a soil scientist. For Federal employment, the minimum qualification for entrance is a bachelor's degree with a major in soil science or in a closely related field of study, with 30 semester hours of course work in the biological, physical, and earth sciences, including a minimum of 12 semester hours in soils. For students interested in working in the Soil Conservation Service, one of the best courses of study is agronomy, the study of how plants and soils interact. Also, a major in agriculture may enable an applicant to find employment with the Soil Conservation Service. In addition, courses in chemistry and cartography, or mapmaking, are helpful to people interested in this career, and are required by some employers. Soil scientists often must write reports decribing their work and thus need some writing skills.

Soil scientists who have been trained in both field work and laboratory research may have the edge in obtaining the best jobs, and an advanced degree—especially a doctorate degree—may be needed to advance to the more responsible and better paying research jobs. Also, a strong background in chemistry may be necessary for obtaining research positions.

Many colleges and universities offer fellowships and assistantships for graduate training, or employ graduate students for part-time teaching or research.

A few States now require certification of soil scientists who inspect soil conditions prior to construction activities. One such certification program requires candidates for certification to have a bachelor's degree and 3 years of experience as a soil scientist, or a master's degree and 2 years of experience. In addition, candidates must complete a written examination, demonstrating their knowledge of soil science.

Soil scientists often can transfer to related occupations such as land appraiser or farm management advisor.

Employment Outlook

One of the major objectives of the Soil Conservation Service is to complete the soil classification survey of all rural lands in the United States. This program includes soil classification and soil interpretation for use by agriculturists, engineers, and land-use planners. Although the number of soil scientists working on this project has not changed over the past decade, about 100 openings arise

Most soil scientists work for the Federal Government, State experimental stations, and colleges of agriculture.

each year to replace those scientists who retire, die, or leave the Soil Conservation Service for other reasons.

In addition, some employment growth may be expected in State and local government agencies as concern for pollution and destruction of our soil resources increases. Employment growth also is expected in the private sector of the economy, in businesses such as fertilizer manufacturers, and with lending institutions that make loans for farm lands, such as banks, mortagage companies, and life insurance companies. However, openings for soil scientists may not keep pace with the number of jobseekers in this field.

Earnings and Working Conditions

The incomes of soil scientists depend upon their education, professional experience, and individual abilities. The entrance salary in the Federal service for graduates having a B.S. degree was $9,303 in 1977. They may expect advancement to $11,523 after 1 year of satisfactory performance. Those who had outstanding records in college, or a master's degree, started at $11,523, and could advance to $14,097 after 1 year. Further promotion depends upon the individual's ability to do high quality work and to accept responsibility. Earnings of well-qualified Federal soil scientists with several years of experience ranged from $17,046 to $28,725 a year.

Soil scientists generally spend much of their time doing field work, which requires them to travel within their area—usually within a county. During inclement weather they generally work in an office, preparing maps and writing reports. Researchers spend much of their time doing experiments in fields and greenhouses.

Sources of Additional Information

Additional information may be obtained from the U.S. Civil Service Commission, Washington, D.C. 20415; U.S. Department of Agriculture, Office of Personnel, Washington, D.C. 20250; any office of the Department's Soil Conservation Service; any college of agriculture; the American Society of Agronomy, 677 S. Segoe Rd., Madison, Wis. 53711; or the Soil Society of America, 677 S. Segoe Rd., Madison, Wis. 53711.

See also statements on chemists and life scientists elsewhere in the *Handbook*.

MATHEMATICS OCCUPATIONS

Mathematics is both a science and a tool essential for many kinds of work. As a tool, mathematics is necessary for understanding and expressing ideas in science, engineering, and, increasingly, in human affairs. The application of mathematical techniques in these fields has increased greatly because of the widespread use of computers, which enable mathematicians to solve complex problems rapidly and efficiently. As a result, persons trained in mathematics are employed in all sectors of the economy including private industry, government, and colleges and universities.

Persons considering careers in mathematics should be able to concentrate for long periods of time. They should enjoy working independently with ideas and solving problems, and must be able to present their findings in written reports.

This section describes two occupations—mathematician and statistician. A statement on actuaries, a closely related mathematics occupation, is discussed in the section on insurance occupations. Entrance into any of these fields requires college training in mathematics. For many types of work, graduate education is necessary.

Many other workers in the natural and social sciences and in data processing use mathematics extensively, although they are not primarily mathematicians. These occupations are discussed elsewhere in the *Handbook*, as are jobs for high school mathematics teachers, covered in the statement on secondary school teachers.

MATHEMATICIANS

(D.O.T. 020.088)

Nature of the Work

Mathematicians work with one of the oldest and most vital of all sciences. Mathematicians today are engaged in a wide variety of activities, ranging from the creation of new theories to the translation of scientific and managerial problems into mathematical terms.

Mathematical work falls into two broad classes: theoretical (pure) mathematics; and applied mathematics. However, these classes are not sharply defined and often overlap.

Theoretical mathematicians advance mathematical science by developing new principles and new relationships between existing principles of mathematics. Although they seek to increase basic knowledge without necessarily considering its practical use, this pure and abstract knowledge has been instrumental in producing many scientific and engineering achievements. For

Mathematicians should have a good knowledge of computer programming since most complex mathematical computation is done by computer.

example, in 1854 Bernard Riemann invented a seemingly impractical non-Euclidian geometry that was to become part of Albert Einstein's theory of relativity. Years later, this theory contributed to the creation of atomic power.

Mathematicians in applied work use mathematics to develop theories, techniques, and approaches to solve practical problems in business, government, engineering, and the natural and social sciences. Their work ranges from analysis of the mathematical aspects of launching earth satellites to studies of the effects of new drugs on disease.

Much work in applied mathematics, however, is carried on by persons other than mathematicians. In fact, the number of workers who depend upon mathematical expertise is many times greater than the number actually designated as mathematicians.

Places of Employment

About 38,000 persons worked as mathematicians in 1976. Roughly three-fourths of all mathematicians worked in colleges and universities. Most were teachers; some worked mainly in research and development with few or no teaching duties.

Most other mathematicians worked in private industry and government. In the private sector, major employers were the aerospace, communications, machinery, and electrical equipment industries. The Department of Defense and the National Aeronautics and Space Administration employed most of the mathematicians working in the Federal Government.

Mathematicians work in all States, but are concentrated in those with large industrial areas and large college and university enrollments. Nearly half of the total are employed in seven States—California, New York, Massachusetts, Pennsylvania, Illinois, Maryland, and New Jersey. Of the total, one-fourth live in three metropolitan areas—New York City; Washington, D.C.; and Los Angeles-Long Beach, California.

Training, Other Qualifications, and Advancement

An advanced degree is the basic requirement for beginning teaching jobs, as well as for most research positions. In most colleges and universities, the Ph. D. degree is necessary for full faculty status.

Although the bachelor's degree may be adequate preparation for some jobs in private industry and government, employers usually require an advanced degree. Those bachelor's degree holders who find jobs usually assist senior mathematicians by performing computations and solving less advanced problems in applied mathematics. However, advancement often depends on achieving an advanced degree. Other bachelor's degree holders work as research or teaching assistants in colleges and universities while studying for an advanced degree.

The bachelor's degree in mathematics is offered by most colleges and universities. Mathematics courses usually required for a degree are analytical geometry, calculus, differential equations, probability and statistics, mathematical analysis, and modern algebra. A prospective college mathematics student should take as many mathematics courses as possible while still enrolled in high school.

More than 400 colleges and universities have programs leading to the master's degree in mathematics; about 150 also offer the Ph. D. In graduate school, students build upon the basic knowledge acquired in earlier studies. They usually concentrate on a specific field of mathematics, such as algebra, mathematical analysis, or geometry, by conducting research and taking advanced courses.

For work in applied mathematics, training in the field in which the mathematics will be used is very important. Fields in which applied mathematics is used extensively include physics, engineering, and operations research; of increasing importance are business and industrial management, economics, statistics, chemistry and life sciences, and the behavioral sciences.

Mathematicians should have a good knowledge of computer programming since most complex mathematical computation is done by computer.

Mathematicians need good reasoning ability, persistence, and the ability to apply basic principles to new types of problems. They must be able to communicate well with others since they often must listen to a nonmathematician describe a problem in general terms, and check and recheck to make sure they understand the mathematical solution that is needed.

Employment Outlook

Employment of mathematicians is expected to increase more slowly than the average for all occupations through the mid-1980's. Although the number of degrees granted in mathematics each year is expected to decline, the number of people seeking employment is expected to exceed job openings. As a result, persons seeking employment as mathematicians are likely to face keen competition throughout the period.

Theoretical mathematicians, who have traditionally found jobs in colleges and universities, are expected to experience the most difficulty in finding employment because colleges and universities are not expected to increase their employment of mathematicians much, if any, beyond present levels.

Holders of advanced degrees in applied mathematics should have the least difficulty in finding satisfactory employment. Although some limited opportunities may be available to theoretical mathematicians in nonacademic areas, most employers will seek applied mathematicians who are capable of applying their special mathematical skills to practical problems. Private industry and governmental agencies will need applied mathematicians for work in operations research, numerical analysis, computer systems programming, applied mathematical physics, market research and commercial surveys, and as consultants in industrial laboratories. Work in applied mathematics requires both a high degree of mathematical competence and a knowledge of the field of application.

Although mathematician jobs may be difficult to obtain, college graduates with degrees in mathematics

should find their background helpful for careers in other areas. Many jobs rely heavily on the application of mathematical theories and methods. Mathematics majors are likely to find openings in statistics, actuarial work, computer programming, systems analysis, economics, engineering, and physical and life sciences. Employment opportunities in these fields will probably be best for those who combine a major in mathematics with a minor in one of these subjects.

New graduates may also find openings as high school mathematics teachers after completing professional education courses and other requirements for a State teaching certificate. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

In 1976, mathematicians earned average salaries over twice as high as the average for nonsupervisory workers in private industry, except farming. Starting salaries for mathematicians with a bachelor's degree averaged about $11,500 a year. Those with a master's degree could start at about $14,300 annually. Salaries for new graduates having the Ph. D., most of whom had some experience, averaged over $20,000.

In the Federal Government in 1977, mathematicians having the bachelor's degree and no experience could start at either $9,303 or $11,523 a year, depending on their college records. Those with the master's degree could start at $14,097 or $17,056; and persons having the Ph. D. degree could begin at either $17,056 or $20,442. The average salary for all mathematicians in the Federal Government was about $23,100 in 1977.

Salaries paid to college and university mathematics teachers are comparable to those for other faculty members. (See statement on college and university teachers elsewhere in the *Handbook*.)

Sources of Additional Information

Several brochures are available that give facts about the field of mathematics, including career opportunities, professional training, and colleges and universities with degree programs.

Seeking Employment in the Mathematical Sciences is available for 50 cents from:

American Mathematical Society, P.O. Box 6248, Providence, R.I. 02940.

Professional Opportunities in Mathematics (50 cents) and *Guide Book to Departments in the Mathematical Sciences* ($3.00) are provided by:

Mathematical Association of America, 1225 Connecticut Ave. NW., Washington, D.C. 20036.

For specific information on careers in applied mathematics, contact:

Society for Industrial and Applied Mathematics, 33 S. 17th St., Philadelphia, Pa. 19103.

For Federal Government career information, contact any regional office of the U.S. Civil Service Commission or:

Interagency Board of U.S. Civil Service Examiners, 1900 E St. NW., Washington, D.C. 20415.

STATISTICIANS

(D.O.T. 020.188)

Nature of the Work

Statistics are numbers that help describe the characteristics of the world and its inhabitants. Statisticians devise, carry out, and interpret the numerical results of surveys and experiments. In doing so, they apply their knowledge of statistical methods to a particular subject area, such as economics, human behavior, natural science, or engineering. They may use statistical techniques to predict population growth or economic conditions, develop quality control tests for manufactured products, or help business managers and government officials make decisions and evaluate the results of new programs.

Often statisticians are able to obtain accurate information about a group of people or things by surveying a small portion, called a sample, rather than the whole group. For example, television rating services ask only a few thousand families, rather than all viewers, what programs they watch to determine the size of the audience. Statisticians decide where to get the data, determine the type and size of the sample group, and develop the survey questionnaire or reporting form. They also prepare instructions for workers who will tabulate the returns. Statisticians who design experiments prepare mathematical models to test a particular theory. Those in analytical work interpret collected data and summarize their findings in tables, charts, and written reports. Some statisticians, called mathematical statisticians, use mathematical theory to design and improve statistical methods.

Because the field of statistics has such a wide application, it sometimes is difficult to distinguish statisticians from specialists in other fields who use statistics. For example, a statistician working with data on economic conditions may have the title of economist.

Places of Employment

Approximately 24,000 persons worked as statisticians in 1976. About two out of three statisticians were in private industry, primarily in manufacturing, public utilities, finance, and insurance companies. Roughly one-eighth worked for the Federal Government, primarily in the Departments of Commerce; Health, Education, and Welfare; Agriculture; and Defense. Others worked in State and local government and colleges and universities.

Although statisticians work in all parts of the country, most are in metropolitan areas, and about one-fourth work in three areas—New York City; Washington, D.C.; and Los Angeles-Long Beach, California.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in statistics or mathematics is the minimum educational requirement for many beginning jobs in statistics. For other beginning statistical jobs,

Statisticians devise, carry out, and interpret the numerical results of surveys and experiments.

however, a bachelor's degree with a major in an applied field such as economics or natural science and a minor in statistics is preferable. A graduate degree in mathematics or statistics is essential for college and university teaching. Most mathematical statisticians have at least a bachelor's degree in mathematics and an advanced degree in statistics.

About 145 colleges and universities offered statistics as a concentration for a bachelor's degree in 1976. Many schools also offer either a degree in mathematics or a sufficient number of courses in statistics to qualify graduates for beginning positions. Required subjects for statistics majors include mathematics through differential and integral calculus, statistical methods, and probability theory. Courses in computer uses and techniques, if not required, are highly recommended. For quality control positions, training in engineering or a physical or biological science and in the application of statistical methods to manufacturing processes is desirable. For many market research, business analysis, and forecasting jobs, courses in economics and business administration are helpful.

Over 100 colleges and universities offered graduate degrees in statistics in 1976, and many other schools offered one or two graduate level statistics courses. Acceptance into graduate programs does not require an undergraduate degree in statistics although a good mathematics background is essential.

Beginning statisticians who have only the bachelor's degree often spend much of their time performing routine work under the supervision of an experienced statistician. Through experience, they may advance to positions of greater technical and supervisory responsibility. However, opportunities for promotion are best for those with advanced degrees.

Employment Outlook

Employment opportunities for persons who combine training in statistics with knowledge of a field of application are expected to be favorable through the mid-1980's. Besides the faster than average growth expected in this field, additional statisticians will be needed to replace those who die, retire, or transfer to other occupations.

Private industry will require increasing numbers of statisticians for quality control in manufacturing. Statisticians with a knowledge of engineering and the physical sciences will find jobs working with scientists and engineers in research and development. Business firms will rely more heavily than in the past on statisticians to forecast sales, analyze business conditions, modernize accounting procedures, and help solve management problems.

Many fields such as law and history are discovering the usefulness of statistics. As the use of statistics expands into new areas, more statisticians will be needed to apply their special knowledge.

Federal, State, and local government agencies will need statisticians for existing and new programs in fields such as social security, health, and education. Colleges and universities will employ others to teach a growing number of students, as the broader use of statistical methods makes such courses increasingly important to persons majoring in fields other than mathematics and statistics.

Earnings and Working Conditions

In the Federal Government in 1977, statisticians who had the bachelor's degree and no experience could start at either $9,303 or $11,523 a year, depending on their college grades. Beginning statisticians with the master's degree could start at $14,097 or $17,056. Those with the Ph. D. could begin at $17,056 or $20,442. The average annual salary for statisticians in the Federal Government was $24,000 in 1977.

Salaries in private industry were comparable to those in the Federal Government, according to the limited data available.

Statisticians employed by colleges and universities generally receive salaries comparable to those paid other faculty members. (See statement on college and university teachers.) In addition to their regular salaries, statisticians in educational institutions sometimes earn extra income from outside research projects, consulting, and writing.

Sources of Additional Information

For information about career opportunities in statistics, contact:

American Statistical Association, 806 15th St. NW., Washington, D.C. 20005.

Facts on Federal Government jobs are available from:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20414.

For information on a career as a mathematical statistician, contact:

Institute of Mathematical Statistics, 1367 Laurel St., San Carlos, Calif. 94070.

PHYSICAL SCIENTISTS

Physical scientists investigate the structure and composition of the earth and the universe. Four physical science occupations are described in this section: astronomers, chemists, food scientists, and physicists. Astronomers study the nature of the universe and the celestial bodies, while chemists examine the composition and interaction of substances in the world around us. Food scientists search for better ways to commercially process and preserve food. Physicists study the nuclear structure of matter and its relationship to energy. A knowledge of the physical sciences is also required by engineers, environmental scientists, and life scientists; these occupations are described in separate sections elsewhere in the *Handbook*.

Many physical scientists perform research directed toward increasing our knowledge of the universe. Physical scientists also employ the results of research in the development of new products and production processes. Some physical scientists teach in colleges and universities. Others, particularly chemists and food scientists, work in production and sales-related activities in industry.

Many high level jobs in the physical sciences require graduate education and often a Ph. D. degree.

ASTRONOMERS

(D.O.T.021.088)

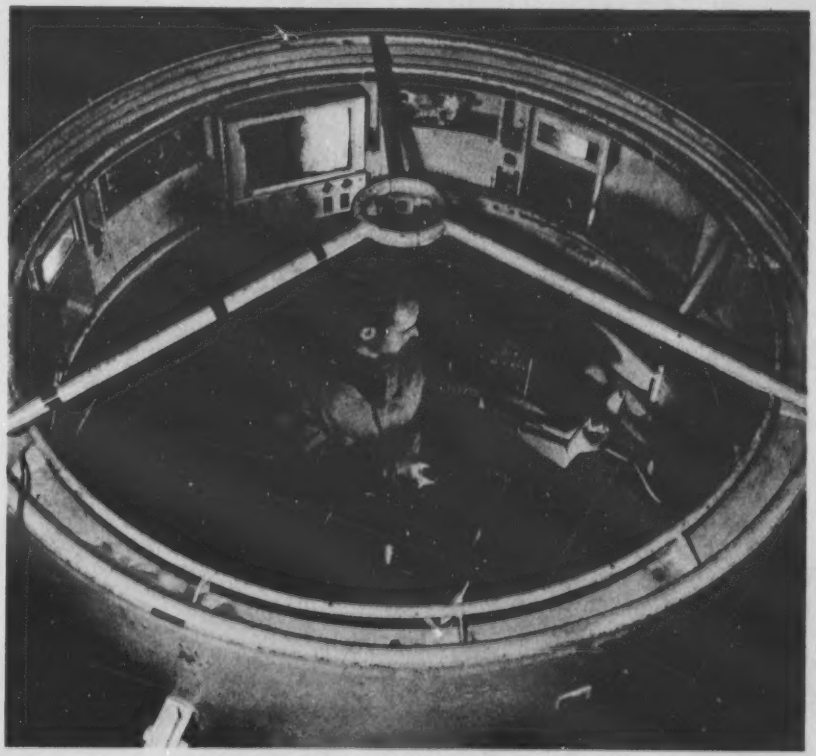
Nature of the Work

Astronomers seek answers to questions about the fundamental nature of the universe, such as its origin and history and the evolution of our solar system. Astronomers—sometimes called *astrophysicists*—use the principles of physics and mathematics to study and determine the behavior of matter and energy in distant galaxies. One application of the information they gain is to prove or disprove theories of the nature of matter and energy such as Einstein's theory of relativity.

To make observations of the universe, astronomers use large telescopes, radiotelescopes, and other instruments that can detect electromagnetic radiation from distant sources. Astronomers of today spend little time visually observing stars through telescopes because photographic and electronic light-detecting equipment is more effective with dim or distant stars, and galaxies. By using spectroscopes to analyze light from stars astronomers can determine their chemical composition. Astronomers also use radiotelescopes and other electronic means to observe radio waves, X-rays, and cosmic rays. Electronic computers are used to analyze data and to solve complex mathematical equations that astronomers develop to represent various theories. Computers also are useful for processing astronomical data to calculate orbits of asteroids or comets, guide spacecraft, and work out tables for navigational handbooks.

Astronomers usually specialize in one of the many branches of the science such as instruments and techniques, the sun, the solar system, and the evolution and interiors of stars.

Astronomers who work on observational programs begin their studies by deciding what stars or other objects to observe and the methods and instruments to use. They may need to



Almost all astronomers do research or teach.

design optical measuring devices to attach to the telescope to make the required measurements. After completing their observations, they analyze the results, present them in precise numerical form, and explain them on the basis of some theory. Astromomers usually spend relatively little time in actual observation and relatively more time in analyzing the large quantities of data that observatory facilities collect.

Some astronomers concentrate on theoretical problems and seldom visit observatories. They formulate theories or mathematical models to explain observations made earlier by other astronomers. These astronomers develop mathematical equations using the laws of physics to compute, for example, theoretical models of how stars change as their nuclear energy sources become exhausted.

Almost all astronomers do research or teach; those in colleges and universities often do both. In schools that do not have separate departments of astronomy or only small enrollments in the subject, they often teach courses in mathematics or physics as well as astronomy. Some astronomers administer research programs, develop and design astronomical instruments, and do consulting work.

Places of Employment

Astronomy is the smallest physical science; only 2,000 persons worked as astronomers in 1976. Most astronomers work in colleges and universities. Some work in observatories operated by universities, nonprofit organizations, and the Federal Government.

The Federal Government employed almost 600 astronomers and space scientists in 1976. Most worked for the National Aeronautics and Space Administration. Others worked for the Department of Defense, mainly at the U.S. Naval Observatory and the U.S. Naval Research Laboratory. A few astronomers worked for firms in the aerospace field, or in museums and planetariums.

Training, Other Qualifications, and Advancement

The usual requirement for a job in astronomy is a Ph. D. degree. Persons with less education may qualify for some jobs; however, high-level positions in teaching and research and advancement in most areas are open only to those with the doctorate.

Many students who undertake graduate study in astronomy have a bachelor's degree in astronomy. In 1976, about 50 colleges and universities had programs leading to the bachelor's degree in astronomy. However, students with a bachelor's degree in physics, or in mathematics with a physics minor, usually can qualify for graduate programs in astronomy.

About 55 universities offer the Ph. D. degree in astronomy. These programs include advanced courses in astronomy, physics, and mathematics. Some schools require that graduate students spend several months working at an observatory. In most institutions, the work program leading to the doctorate is flexible and allows students to take courses in their own particular area of interest.

Persons planning careers in astronomy should have imagination and an inquisitive mind. Perseverance and the ability to concentrate on detail and to work independently also are important.

New graduates with a bachelor's or master's degree in astronomy usually begin as assistants in observatories, planetariums, large departments of astronomy in colleges and universities, Government agencies, or industry. Some work as research assistants while studying toward advanced degrees. New graduates with the doctorate can qualify for teaching and research jobs in colleges and universities and for research jobs in Government and industry.

Employment Outlook

Persons seeking positions as astronomers will face keen competition for the few available openings expected through the mid-1980's. Employment of astronomers is expected to grow slowly, if at all, because the funds available for basic research in astronomy, which come mainly from the Federal Government, are not expected to increase enough to create many new positions. Most openings will occur as replacements for those who die or retire. Since astronomy is such a small profession, there will be few openings needed for replacements. There will be keen competition for these openings because the number of degrees granted in astronomy probably will continue to exceed available openings.

Earnings and Working Conditions

Astronomers have relatively high salaries, with average earnings more than twice the average earnings for nonsupervisory workers in private industry, except farming.

In the Federal Government in 1977, astronomers holding the Ph. D. degree could begin at $17,056 or $20,442 depending on their college record. Those having the bachelor's degree could start at $9,303 or $11,523; with the master's degree at $11,523 or $14,097. The average annual salary for astronomers and space scientists in the Federal Government was about $25,100 in 1977. Astronomers teaching in colleges and universities received salaries equivalent to those of other faculty members. (See statement on college and university teachers elsewhere in the *Handbook*.)

Most astronomers spend most of their time working in offices or classrooms, although astronomers who make observations may need to travel to the observing facility and frequently work at night.

Sources of Additional Information

For information on careers in astronomy and on schools offering training in the field, contact:

American Astronomical Society, 211 FitzRandolph Rd., Princeton, N.J. 08540.

CHEMISTS

(D.O.T. 022.081, .168, .181, and.281)

Nature of the Work

The clothes we wear, the foods we eat, the houses in which we live—in fact most things that help make our lives better, from medical care to a cleaner environment—result, in part, from the work done by chemists.

Chemists search for and put into practical use new knowledge about substances. They develop new compounds, such as rocket fuel; improve foods; and create clothing that is chemically treated against flammability, soil, and wrinkles.

Over one-half of all chemists work in research and development. In basic research, chemists investigate the properties and composition of matter and the laws that govern the combination of elements. Basic research often has practical uses. For example, synthetic rubber and plastics have resulted from research on small molecules uniting to form larger ones (polymerization). In research and development, new products are created or improved. The process of developing a product begins with descriptions of the characteristics it should have. If similar products exist, chemists test samples to determine their ingredients. If no such product exists, experimentation with various substances yields a product with the required specifications.

Nearly one-fifth of all chemists work in production and inspection. In production, chemists prepare instructions (batch sheets) for plant workers that specify the kind and amount of ingredients to use and the exact mixing time for each stage in the process. At each step, samples are tested for quality control to meet industry and government standards. Records and reports show results of tests.

Others work as marketing or sales representatives to obtain technical knowledge of products sold. A number of chemists teach in colleges and universities. Some chemists are consultants to private industry and to government agencies.

Chemists often specialize in one of the subfields of chemistry. *Analytical chemists* determine the structure, composition, and nature of substances, and develop new techniques. An outstanding example was the analysis of moon rocks by an international team of analytical chemists. *Organic chemists* at one time studied the chemistry of only living things, but this area has been broadened to include all carbon compounds. When combined with other elements, carbon forms a vast number of substances. Many modern commercial products, including plastics and other synthetics, have resulted from the work of organic chemists. *Inorganic chemists* study compounds other than carbon. They may, for example, develop materials to use in solid state electronic components. *Physical chemists* study energy transformations to find new and better energy sources. Increasingly, however, chemists consider themselves members of new specialties that include two of the preceding fields or more. *Biochemists*, often considered as either chemists or life scientists, are discussed elsewhere in the *Handbook*. Some chemists specialize in the chemistry of foods. (See statement on food scientists elsewhere in the *Handbook*.)

Many modern products, including plastics and other synthetics, have resulted from research in chemistry.

Places of Employment

Nearly 150,000 persons worked as chemists in 1976. About three-fifths of all chemists work in private industry, almost one-half of them in the chemical manufacturing industry. Most others work for companies manufacturing food, scientific instruments, petroleum, paper, and electrical equipment.

Colleges and universities employed 25,000 chemists in 1976. An equal number worked for State and local governments, primarily in health and agriculture, and for Federal agencies, chiefly the Department of Defense; Health, Education, and Welfare; Agriculture; and Interior. Smaller numbers worked for nonprofit research organizations.

Chemists are employed in all parts of the country, but they are concentrated in large industrial areas. Nearly one-fifth of all chemists were located in four metropolitan areas—New York, Chicago, Philadelphia, and Newark. About half worked in six States—New York, New Jersey, California, Pennsylvania, Ohio, and Illinois.

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in chemistry or a related discipline is sufficient for many beginning jobs as a chemist. However, graduate training is required for many research and college teaching positions. Beginning chemists should have a broad background in chemistry, with good laboratory skills.

About 1,175 colleges and universities offer a bachelor's degree in chemistry. In addition to required courses in analytical, inorganic, organic, and physical chemistry, undergraduates usually study mathematics and physics.

More than 350 colleges and universities award advanced degrees in chemistry. In graduate school, students generally specialize in a particular subfield of chemistry. Requirements for the master's and doctor's degree usually include a thesis based on independent research.

Students planning careers as chemists should enjoy studying science and mathematics, and should like working with their hands building scientific apparatus and performing experiments. Perseverance and the ability to concentrate on detail and to work independently are essential. Other desirable assets include an inquisitive mind, and imagination. Chemists also should have good eyesight and eye-hand coordination.

Graduates with the bachelor's degree generally begin their careers in government or industry by analyzing or testing products, working in technical sales or service, or assisting senior chemists in research and development laboratories. Many employers have special training and orientation programs which are concerned with the special knowledge needed for the employer's type of work. Candidates for an advanced degree often teach or do research in colleges and universities while working toward advanced degrees.

Beginning chemists with the master's degree can usually go into applied research in government or private industry. They also may qualify for teaching positions in 2-year colleges and some universities.

The Ph. D. generally is required for basic research, for teaching in colleges and universities, and for advancement to many administrative positions.

Employment Outlook

Employment opportunities in chemistry are expected to be good for graduates at all degree levels through the mid-1980's. The employment of chemists is expected to grow about as fast as the average for all occupations during this period; thousands of new jobs will be created each year. In addition, several thousand openings will result each year as chemists retire, die, or transfer to other occupations.

This outlook for chemists is based on the assumption that research and development expenditures of government and industry will increase through the mid-1980's, although at a slower rate than during the 1960's. If actual expenditures differ significantly from those assumed, the outlook for chemists would be altered.

Approximately three-fourths of total employment is expected to be in private industry, primarily in the development of new products. In addition, industrial companies and government agencies will need chemists to help solve problems related to energy shortages, pollution control, and health care. Some also will work in Federal, State, and local crime laboratories.

Little growth in college and university employment is expected, and competition for teaching positions will be keen. (See statement on college and university teachers elsewhere in the *Handbook*.)

Some graduates will find openings in high school teaching after completing professional education courses and other requirements for a State teaching certificate. They usually are then regarded as teachers rather than chemists. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Earnings of chemists averaged more than twice as much as those of nonsupervisory workers in private industry, except farming. According to the American Chemical Society, salaries of experienced chemists having a bachelor's degree averaged $21,200 a year in 1976; for those with a master's degree, $22,100; and for those with a Ph. D., $25,800.

Private industry paid chemists with the bachelor's degree starting salaries averaging $11,500 a year in 1976,; those with the master's degree, $13,600; and those with the Ph. D., $18,700.

In colleges and universities, the average salary of those with the master's degree was $17,000 and of those with the Ph. D., $21,000. In addition, many experienced chemists in educational institutions supplement their regular salaries with income from consulting, lecturing, and writing.

Depending on a person's college record, the annual starting salary in the Federal Government in 1977 for an inexperienced chemist with a bachelor's degree was either $9,303 or $11,523. Those who had 2 years of graduate study could begin at $14,097 a year. Chemists having the Ph. D. degree could start at $17,056 or $20,442. The average salary for all chemists in the Federal Government in 1977 was $19,900 a year.

Chemists usually work in modern, well-equipped, and well-lighted laboratories, offices, or classrooms. Some hazard is involved in handling potentially explosive or highly caustic chemicals. However, when safety regulations are followed, health hazards are negligible.

Sources of Additional Information

General information on career opportunities and earnings for chemists is available from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists Association, 1825 Connecticut Ave. NW., Washington, D.C. 20009.

For specific information on Federal Government careers, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

For additional sources of information, see statements on biochemists, chemical engineers, food scientists, and the industrial chemical industry. Information on chemical technicians may be found in the statement on engineering and science technicians.

FOOD SCIENTISTS

(D.O.T. 022.081, 040.081, and 041.081)

Nature of the Work

In the past, consumers processed most food in the home, but today industry processes almost all foods. A key worker involved in the development and processing of the large variety of foods available today is the *food scientist* or *food technologist*.

Food scientists investigate the chemical, physical, and biological nature of food and apply this knowledge to processing, preserving, packaging, distributing, and storing an adequate, nutritious, wholesome, and economical food supply. About three-fifths of all scientists in food processing work in research and development. Others work in quality assurance laboratories or in production or processing areas of food plants. Some teach or do basic research in colleges and universities.

Food scientists in basic research study the structure and composition of food and the changes it undergoes in storage and processing. For example, they may develop new sources of proteins, study the effects of processing on microorganisms, or search for factors that affect the flavor, texture, or appearance of foods. Food scientists who work in applied research and development create new foods

Food scientists conduct tests to identify bacterial cultures.

and develop new processing methods. They also seek to improve existing foods by making them more nutritious and enhancing their flavor, color, and texture.

Food scientists insure that each product will retain its characteristics and nutritive value during storage. They also conduct chemical and microbiological tests to see that products meet industry and government standards, and they may determine the nutritive contents of products in order to comply with Federal nutritional labeling requirements.

In quality control laboratories, food scientists check raw ingredients for freshness, maturity, or suitability for processing. They may use machines that test for tenderness by finding the amount of force necessary to puncture the item. Periodically, they inspect processing line operations to insure conformance with government and industry standards. For example, scientists test processed foods for sugar, starch, protein, fat, vitamin, and mineral content. They make sure that, after processing, various enzymes are inactive and microbial levels are adequately low so that the food will not spoil during storage or present a safety hazard. Other food scientists are involved in developing and improving packaging and storage methods.

Food scientists in production prepare production specifications, schedule processing operations, maintain proper temperature and humidity in storage areas, and supervise sanitation operations, including the efficient and economical disposal of wastes. To increase efficiency, they advise management on the purchase of equipment and recommend new sources of materials.

Some food scientists apply their knowledge in areas such as market research, advertising, and technical sales. Others teach in colleges and universities.

Places of Employment

About 7,000 persons worked as food scientists in 1976. Food scientists work in all sectors of the food industry and in every State. The types of products and processes with which they work may depend on the locality. For example, in Maine and Idaho they work with potato processing; in the Midwest, with cereal products and meatpacking; and in Florida and California, with citrus fruits and vegetables.

Some food scientists do research for Federal agencies such as the Food and Drug Administration and the Departments of Agriculture and Defense; others work in State regulatory agencies. A few work for private consulting firms and international organizations such as the United Nations. Some teach or do research in colleges and universities. (See statement on college and university teachers elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

A bachelor's degree with a major in food science, or in one of the physical or life sciences such as chemistry and biology, is the usual minimum requirement for beginning jobs in food science. An advanced degree is necessary for many jobs, particularly research and college teaching and for some management level jobs in industry.

About 60 colleges and universities offered programs leading to the bachelor's degree in food science in 1976. Undergraduate students majoring in food science usually take courses in physics, chemistry, mathematics, biology, the social sciences and humanities, and business administration, as well as a variety of food science courses. Food science courses cover areas such as preservation, processing, sanitation, and marketing of foods.

Most of the colleges and universities that provide undergraduate food science programs also offer advanced degrees. Graduate students usually specialize in a particular area of food science. Requirements for the master's or doctor's degree vary by institution, but usually include extensive laboratory work and a thesis.

People planning careers as food scientists should have analytical minds and like details and technical work. Food scientists must be able to express their ideas clearly to others.

Food scientists with a bachelor's degree might start work as quality assurance chemists or as assistant production managers. After gaining experience, they can advance to more responsible management jobs. A food scientist might also begin as a junior food chemist in a research and development laboratory of a food company, and be promoted to section head or another research management position.

People who have master's degrees may begin as senior food chemists in a research and development laboratory. Those who have the Ph. D. degree usually begin their careers doing basic research or teaching.

Employment Outlook

Employment of food scientists is expected to grow about as fast as the average for all occupations through the mid-1980's. Most openings will result from the need to replace those who die, retire, or transfer to other fields, although some openings will arise from employment growth.

Employment is expected to grow as the food industry responds to the challenge of providing wholesome and economical foods that can meet changing consumer preferences and food standards. In addition, both private households and food service institutions that supply customers such as airlines and restaurants will demand a greater quantity of processed convenience foods.

Employment opportunities should generally be favorable through the mid-1980's for food scientists with degrees in food science. Opportunities may not be as good for scientists with degrees in related fields such as chemistry or biology. Food scientists with advanced degrees are expected to have more favorable opportunities than those with only a bachelor's degree.

An increasing number of food scientists are expected to find jobs in research and product development. In recent years, expenditures for research and development in the food industry have increased moderately and probably will continue to rise. Through research, new foods are being produced from modifications of wheat, corn, rice, and soybeans. For example, food scientists are working to improve "meat" products made from vegetable proteins. There will be an increased need for food scientists in quality control and production because of the complexity of products and processes and the application of higher processing standards and new government regulations.

Earnings and Working Conditions

Food scientists had relatively high earnings in 1976, twice as high as the average for all nonsupervisory workers in private industry, except farming. Food scientists with the bachelor's degree had average starting salaries of about $11,300 a year in 1976. Those with a master's degree started at about $13,500, and those with the Ph. D. degree at about $17,400.

In the Federal Government in 1977, food scientists with a bachelor's degree could start at $9,303 or $11,523 a year, depending on their college grades. Those with a master's degree could start at $11,523 or $14,097, and those with the Ph. D. degree could begin at $17,056 or $20,442. The average salary for experienced food scientists in the Federal Government was about $21,500 a year in 1977.

Sources of Additional Information

For information on careers in food science, contact:

Institute of Food Technologists, Suite 2120, 221 North LaSalle St., Chicago, Ill. 60601.

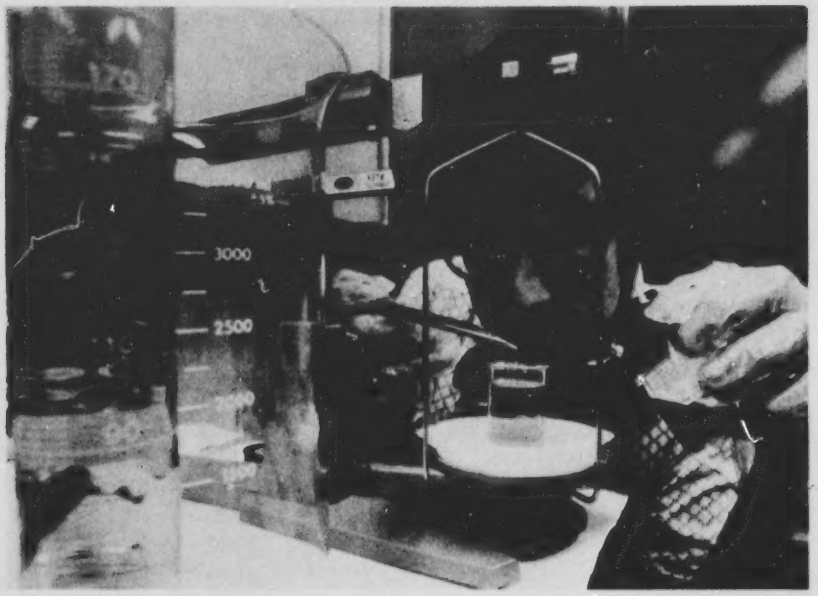
PHYSICISTS

(D.O.T. 023.081 and.088)

Nature of the Work

The flight of astronauts through space, the probing of ocean depths, or even the safety of the family car depend on research by physicists. Through systematic observation and experimentation, physicists describe in mathematical terms the structure of the universe and interaction of matter and energy. Physicists develop theories that describe the fundamental forces and laws of nature. Determining such basic laws governing phenomena such as gravity, electromagnetism, and nuclear interaction leads to discoveries and innovations. For instance, the development of irradiation therapy equipment which destroys harmful growths in humans without damaging other tissues resulted from what physicists know about nuclear radiation. Physicists have contributed to scientific progress in recent years in areas such as nuclear energy, electronics, communications, aerospace, and medical instrumentation.

The majority of all physicists work in research and development. Some do basic research to increase scientific knowledge. For example, they investigate the fundamentals of nuclear structure and the forces between nucleons (nuclear dynamics). The equipment that physicists design for their basic research can often be applied to other areas. For example, lasers (devices that amplify light and



Physicist developing a coating for optical fibers.

emit electromagnetic waves in a narrow, intense light beam) are utilized in surgery; microwave devices are used for ovens; and measurement techniques and instruments developed by physicists can detect and measure the kind and number of cells in blood or the amount of mercury or lead in foods.

Some engineering-oriented physicists do applied research and help develop new products. For instance, their knowledge of solid-state physics led to the development of transistors and microcircuits used in electronic equipment that ranges from hearing aids to missile guidance systems.

Many physicists teach and do research in colleges and universities. A small number work in inspection, quality control, and other production-related jobs in industry. Some do consulting work.

Most physicists specialize in one branch or more of the science—elementary-particle physics; nuclear physics; atomic, electron, and molecular physics; physics of condensed matter; optics, acoustics, and plasma physics; and the physics of fluids. Some specialize in a subdivision of one of these branches. For example, within solid-state physics subdivisions include ceramics, crystallography, and semiconductors. However, since all physics specialties rest on the same fundamental principles, a physicist's work usually overlaps several specialties.

Growing numbers of physicists are specializing in fields combining physics and a related science—such as astrophysics, biophysics, chemical physics, and geophysics. Furthermore, the practical applications of physicists' work have increasingly merged with engineering.

Places of Employment

About 48,000 people worked as physicists in 1976. Private industry employed nearly one out of three physicists, primarily in companies manufacturing chemicals, electrical equipment, and aircraft and missiles. Many others worked in hospitals, commercial laboratories, and independent research organizations.

Nearly one-half of all physicists taught or did research in colleges and universities; some did both. About 8,000 physicists were employed by the Federal Government in 1976, mostly in the Departments of Defense and Commerce.

Although physicists are employed in all parts of the country, their employment is greatest in areas that have heavy industrial concentrations and large college and university enrollments. Nearly one-fourth of all physicists work in four metropolitan areas—Washington, D.C.; Boston, Mass.; New York, N.Y.; and Los Angeles-Long Beach, Calif., and more than one-third are concentrated in three States—California, New York, and Massachusetts.

Training, Other Qualifications, and Advancement

Graduate training in physics or a closely related field is almost essential for most entry level jobs in physics and for advancement in all types of work. The doctorate usually is required for full faculty status at colleges and universities and for industrial or government jobs administering research and development programs.

Those having master's degrees qualify for many research jobs in private industry and in the Federal Government. Some work in colleges and universities, instructing and assisting in research while studying for their Ph. D.

Those having bachelor's degrees qualify for some applied research and development jobs in private industry and in the Federal Government. Some are employed as research assistants in colleges and universities while studying for advanced degrees. Many with a bachelor's degree in physics apply their physics training primarily in jobs in engineering and other scientific fields. (See statements on engineers, geophysicists, programmers, and systems analysts elsewhere in the *Handbook*.)

Over 800 colleges and universities offer a bachelor's degree in physics. In addition, many engineering schools offer a physics major as part of the general curriculum. The undergraduate program in physics provides a broad background in the science and serves as a base for later specialization either in graduate school or on the job. Some typical physics courses are mechanics, electricity and magnetism, optics, thermodynamics, and atomic and molecular physics. Students also take courses in chemistry and require many courses in mathematics.

About 300 colleges and universities offer advanced degrees in physics. In graduate school, the student, with faculty guidance, usually works in a specific field. The graduate student, especially the candidate for the Ph. D. degree, spends a large portion of his or her time in research.

Students planning a career in physics should have an inquisitive mind, mathematical ability, and imagination. They should be able to work on their own, since physicists, particularly in basic research, often receive only limited supervision.

Physicists often begin their careers doing routine laboratory tasks. After some experience, they are assigned more complex tasks and may advance to work as project leaders or research directors. Some work in top management jobs. Physicists who develop new products frequently form their own companies or join new firms to exploit their own ideas.

Employment Outlook

Employment opportunities in physics are expected to be favorable through the mid-1980's for persons with graduate degrees in physics. Although employment of physicists is expected to grow more slowly than the average for all occupations over the period, fewer physicists are expected to enter the labor force than in the past. The number of graduate degrees awarded annually in physics has been declining since 1970, and this trend is expected to continue through the mid-1980's. Most job openings will arise as physicists retire, die, or transfer to other occupations.

Many physicists work in research and development (R&D). The anticipated rapid increase in R&D expenditures through the mid-1980's should result in increased requirements for physicists. If actual R&D expenditure levels and patterns were to differ significantly from those assumed, however, the outlook for physicists would be altered.

Some physicists with advanced degrees will be needed to teach in colleges and universities, but competition for these jobs is expected to be keen. The number of teaching jobs is expected to decline as the number of physics degrees awarded falls over the 1976 to 1985 period.

Persons with only a bachelor's degree in physics are expected to face keen competition for physicist jobs through the mid-1980's. Some new graduates will find employment as engineers or technicians. Others will find opportunities as high school physics teachers after completing the required educational courses and obtaining a State teaching certificate. However, they are usually regarded as teachers rather than as physicists. (See statement on secondary school teachers elsewhere in the *Handbook*.)

Earnings and Working Conditions

Physicists have relatively high salaries, with average earnings more than twice those of nonsupervisory workers in private industry, except farming. Starting salaries for physicists who had a bachelor's degree averaged about $12,600 a year in manufacturing industries in 1976; a master's degree, $13,600; and a Ph. D., $19,000.

Depending on their college records, physicists with a bachelor's degree could start in the Federal Government in 1977, at either $9,303 or $11,523 a year. Beginning physicists having a master's degree could start at $11,523 or $14,097, and those having the Ph. D. degree could begin at $17,056 or $20,442. Average earnings for all physicists in the Federal Government in 1977 were $23,850 a year.

Starting salaries on college and university faculties for physicists having a master's degree averaged $10,800 in 1976, and for those having the Ph. D., $12,800. (See statement on college and university teachers elsewhere in the *Handbook*.) Many faculty physicists supplement their regular incomes by working as consultants and taking on special research projects.

Sources of Additional Information

General information on career opportunities in physics is available from:

American Institute of Physics, 335 East 45th St., New York, N.Y. 10017.

For information on Federal Government careers, contact:

Interagency Board of U.S. Civil Service Examiners for Washington, D.C., 1900 E St. NW., Washington, D.C. 20415.

OTHER SCIENTIFIC AND TECHNICAL OCCUPATIONS

BROADCAST TECHNICIANS

(D.O.T. 194.168, .281, .282, and 782; 957.282; and 963.168 through .887)

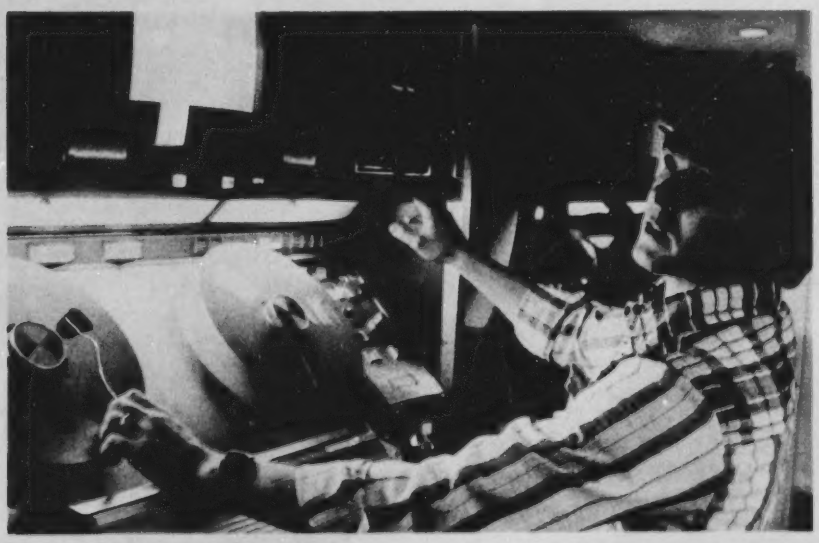
Nature of the Work

Broadcast technicians operate and maintain the electronic equipment used to record and transmit radio and television programs. They work with microphones, sound recorders, light and sound effects, television cameras, video tape recorders, and other equipment.

In the control room, broadcast technicians operate equipment that regulates the quality of sounds and pictures being recorded or broadcast. They also operate controls that switch broadcasts from one camera or studio to another, from film to live programming, or from network to local programs. By means of hand signals and, in television, by use of telephone headsets, they give technical directions to personnel in the studio.

When events outside the studios are to be broadcast, technicians may go to the site and set up, test, and operate the equipment. After the broadcast, they dismantle the equipment and return it to the station.

As a rule, broadcast technicians in small stations perform a variety of duties. In large stations and in networks, on the other hand, technicians are more specialized, although specific job assignments may change from day to day. *Transmitter technicians* monitor and log outgoing signals and are responsible for transmitter operation. *Maintenance technicians* set up, maintain, and repair electronic broadcasting equipment. *Audio control technicians* regulate sound pickup, transmission, and switching, and *video control technicians* regulate the quality, brightness, and contrast of television pictures.



Broadcast technician makes video tape recording on electronic equipment.

The lighting of television programs is directed by *lighting technicians*. For programs originating outside the studio, *field technicians* set up and operate broadcasting equipment. *Recording technicians* operate and maintain sound recording equipment; *video recording technicians* operate and maintain video tape recording equipment. Sometimes the term "engineer" is substituted for "technician."

Places of Employment

About 22,500 broadcast technicians were employed in radio and television stations in 1976. Most radio stations employ fewer than four technicians, although a few large ones have more than 10. Nearly all television stations employ at least 10 broadcast technicians, and those in large metropolitan areas average about 30. In addition to the technicians, some supervisory personnel, with job titles such as chief engineer or director of engineering, work in engineering departments.

Although broadcast technicians are employed in every State, most are located in large metropolitan areas. The highest paying and most specialized jobs are concentrated in New York, Los Angeles, and Washington, D.C.—the originating centers for most of the network programs.

Training, Other Qualifications, and Advancement

A person interested in becoming a broadcast technician should plan to get a First Class Radiotelephone Operator License from the Federal Communications Commission (FCC). Federal law requires that anyone who operates broadcast transmitters in television stations must hold such a license. The law also requires that the chief engineer of a broadcasting station hold a first class license. The FCC issues a Third Class Operator License, too, and some stations require all their broadcast technicians to have one or the other of these licenses. Applicants for an FCC license must pass a series of written examinations. These cover construction and operation of transmission and receiving equipment; characteristics of electromagnetic

waves; and regulations and practices, both Federal and international, which govern broadcasting.

Among high school courses, algebra, trigonometry, physics, electronics, and other sciences provide valuable background for persons anticipating careers in this occupation. Building and operating an amateur radio station also is good training. Taking an electronics course in a technical school is still another good way to acquire the knowledge for becoming a broadcast technician. Some persons gain work experience as temporary employees while filling in for regular broadcast technicians who are on vacation.

Many schools give courses especially designed to prepare the student for the FCC's first class license test. Technical school or college training is an advantage for those who hope to advance to supervisory positions or to the more specialized jobs in large stations and in the networks.

Persons with FCC first class licenses who get entry jobs are instructed and advised by the chief engineer or by other experienced technicians concerning the work procedures of the station. In small stations, they may start by operating the transmitter and handling other technical duties, after a brief instruction period. As they acquire more experience and skill they are assigned to more responsible jobs. Those who demonstrate above-average ability may move into top-level technical positions, such as supervisory technician or chief engineer. A college degree in engineering is becoming increasingly important for advancement to supervisory and executive positions.

Employment Outlook

People seeking beginning jobs as broadcast technicians face competition, especially in major metropolitan areas where the number of qualified jobseekers exceeds the number of openings. Job prospects may be better in smaller cities for people with appropriate training in electronics.

Employment of broadcast technicians is expected to increase about as fast as the average for all occupations through the mid-1980's. Most job openings, however, will result from the need to replace experienced technicians who retire, die, or transfer to other occupations.

Some new job opportunities for technicians will arise as new radio and television stations go on the air. Demand for broadcast technicians also will increase as cable television stations broadcast more of their own programs. At the same time, technological developments are likely to limit future demand; such laborsaving technical advances as automatic programming, automatic operation logging, and remote control of transmitters all hold down demand for additional technicians.

Earnings and Working Conditions

Salaries of beginning technicians in commerical radio and television ranged from about $155 to $215 a week in 1976 and those of experienced technicians from about $200 to $450, according to the limited information available. As a rule, technicians' wages are highest in large cities and in large stations. Technicians employed by television stations usually are paid more than those who work for radio stations because television work is generally more complex. Technicians employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most technicians in large stations work a 40-hour week with overtime pay for additional hours. Some broadcast technicians in the larger cities work a 37-hour week. In small stations, many technicians work 4 to 12 hours of overtime each week. Evening, night, and weekend work frequently is necessary since many stations are on the air as many as 24 hours a day, 7 days a week. Network technicians may occasionally have to work continuously for many hours and under great pressure in order to meet broadcast deadlines.

Technicians generally work indoors in pleasant surroundings. The work is interesting, and the duties are varied. When remote pickups are made, however, technicians may work out of doors at some distance from the studios, under less favorable conditions.

Sources of Additional Information

For information about radiotelephone operator's examinations, and guides to study for them, write to:

Federal Communications Commission, Washington, D.C. 20554.

For information on careers for broadcast technicians, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

DRAFTERS

(D.O.T. 001.281, 002.281, 003.281, 005.281, 007.281, 010.281, 014.281, and 017.)

Nature of the Work

When building a space capsule, television set, or bridge, workers follow drawings that show the exact dimensions and specifications of the entire object and each of its parts. Workers who draw these plans are drafters.

Drafters prepare detailed drawings based on rough sketches, specifications, and calulations made by scientists, engineers, architects, and designers. They also calculate the strength, quality, quantity, and cost of materials. Final drawings contain a detailed view of the object from all sides as well as specifications for materials to be used, procedures followed, and other information to carry out the job.

In preparing drawings, drafters use compasses, dividers, protractors, triangles, and other drafting devices. They also use engineering handbooks, tables, and calculators to help solve technical problems.

Drafters are classified according to the work they do or their level of responsibility. *Senior drafters* trans-

Drafters may specialize in mechanical, electrical, aeronautical, structural, or architectural drafting.

late an engineer's or architect's preliminary plans into design "layouts" (scale drawings of the object to be built). *Detailers* draw each part shown on the layout, and give dimensions, materials, and other information to make the drawing clear and complete. *Checkers* carefully examine drawings for errors in computing or recording dimensions and specifications. Under the supervision of experienced drafters, *tracers* make minor corrections and trace drawings for reproduction on paper or plastic film.

Drafters usually specialize in a particular field of work, such as mechanical, electrical, electronic, aeronautical, structural, or architectural drafting.

Places of Employment

About 320,000 persons worked as drafters in 1976—more than 9 out of 10 worked in private industry. Engineering and architectural firms employed about 3 out of the 10. Other major employers included the fabricated metals, electrical equipment, machinery, and construction industries.

About 20,000 drafters worked for Federal, State, and local governments in 1976. Most drafters in the Federal Government worked for the Defense Department; those in State and local governments were mainly in highway and public works departments. Another several thousand drafters worked for colleges and universities and nonprofit organizations.

Training, Other Qualifications, and Advancement

Persons interested in becoming drafters can acquire the necessary training in technical institutes, junior and community colleges, extension divisions of universities, and vocational and technical high schools. Some persons receive training and experience in the Armed Forces. Others qualify through on-the-job training programs combined with part-time schooling or 3- to 4-year apprenticeship programs.

Training for a career in drafting, whether in a high school or posthigh school program, should include courses in mathematics, physical sciences, mechanical drawing, and drafting. Shop practices and shop skills also are helpful since many higher level drafting jobs require knowledge of manufacturing or construction methods. Many technical schools offer courses in structural design, architectural drawing, and engineering or industrial technology.

Those planning careers in drafting should be able to do freehand drawings of three-dimensional objects and also detailed work requiring a high degree of accuracy. They should have good eyesight and manual dexterity. In addition, they should be able to function as part of a team since they work directly with engineers, architects, and skilled workers. Artistic ability is helpful in some specialized fields.

High school graduates usually start out as tracers. Those having posthigh school technical training may begin as junior drafters. After gaining experience, they may advance to checkers, detailers, senior drafters, or supervisors. Some may become independent designers. Courses in engineering and mathematics sometimes enable drafters to transfer to engineering positions.

Employment Outlook

Employment of drafters is expected to increase faster than the average for all occupations. This growth, along with the need to replace those who retire, die, or move into other fields of work, should provide favorable job opportunities through the mid-1980's. Holders of an associate (2-year) degree in drafting will have the best prospects. Many large employers already require postsecondary technical education, though well-qualified high school graduates who have studied drafting may find opportunities in some types of jobs.

Employment of drafters is expected to rise rapidly as a result of the increasingly complex design problems of modern products and processes. In addition, more support personnel will be needed as the employment of engineers and scientists grows. Photoreproduction of drawings and expanding use of electronic drafting equipment and computers, however, will reduce the need for less skilled drafters.

Earnings and Working Conditions

In private industry, tracers averaged about $8,400 a year in 1976, while more experienced drafters averaged between $9,800 and $12,000 a year. Senior drafters averaged about $15,300 a year in 1976. On the average, experienced drafters earn about one and one-half times as much as the average earnings of nonsupervisory workers in private industry, except farming.

The Federal Government paid drafters having an associate degree starting salaries of $8,316 a year in 1977. Those with less education or experience generally started at $7,408. The average Federal Gov-

ernment salary for all drafters was about $11,000 a year.

Although drafters usually work in well-lighted and well-ventilated rooms, they often must sit for long periods of time doing very detailed work. Occasionally, drafters may visit other offices or construction sites to gain first-hand information about a certain assignment.

Sources of Additional Information

General information on careers for drafters is available from:

American Institute for Design and Drafting, 3119 Price Rd., Bartlesville, Okla. 74003.

International Federation of Professional and Technical Engineers, 1126 16th St. NW., Washington, D.C. 20036.

See Sources of Additional Information in the statement on engineering and science technicians elsewhere in the *Handbook*.

ENGINEERING AND SCIENCE TECHNICIANS

(D.O.T. 002. through 029.)

Nature of the Work

Knowledge of science, mathematics, industrial machinery, and technical processes enables engineering and science technicians to work in all phases of business and government, from research and design to manufacturing, sales, and customer service. Although their jobs are more limited in scope and more practically oriented than those of engineers or scientists, technicians often apply the theoretical knowledge developed by engineers and scientists to actual situations. Technicians frequently use complex electronic and mechanical instruments, experimental laboratory equipment, and drafting instruments. Almost all technicians described in this statement must be able to use technical handbooks and computing devices such as slide rules and calculating machines.

In research and development, one of the largest areas of employment, technicians set up experiments and calculate the results using complex instruments. They also assist engineers and scientists in developing experimental equipment and models by making drawings and sketches and, frequently, by doing routine design work.

In production, technicians usually follow the plans and general directions of engineers and scientists, but often without close supervision. They may prepare specifications for materials, devise tests to insure product quality, or study ways to improve the efficiency of an operation. They often supervise production workers to make sure they follow prescribed plans and procedures. As a product is built, technicians check to see that specifications are followed, keep engineers and scientists informed as to progress, and investigate production problems.

As sales workers or field representatives for manufacturers, technicians give advice on installation and maintenance of complex machinery, and may write specifications and technical manuals. (See statement on technical writers elsewhere in the *Handbook*.)

Technicians may work in the fields of engineering, physical science, or life science. Within these general fields, job titles may describe the level (biological aide or biological technician), duties (quality control technician or time study analyst), or area of work (mechanical, electrical, or chemical).

As an engineering technician, one might work in any of the following areas:

Aeronautical Technology. Technicians in this area work with engineers and scientists to design and produce aircraft, rockets, guided missiles, and spacecraft. Many aid engineers in preparing design layouts and models of structures, control systems, or equipment installations by collecting information, making computations, and performing laboratory tests. For example, a technician might estimate weight factors, centers of gravity, and other items affecting load capacity of an airplane or missile. Other technicians prepare or check drawings for technical accuracy, practicability, and economy.

Aeronautical technicians frequently work as manufacturers' field service representatives, serving as the link between their company and the military services, commercial airlines, and other customers. Technicians also prepare technical information for instruction manuals, bulletins, catalogs, and other literature. (See statements on aerospace engineers, airplane mechanics, and occupations in aircraft, missile, and spacecraft manufacturing elsewhere in the *Handbook*.)

Air-Conditioning, Heating, and Refrigeration Technology. Air-conditioning, heating, and refrigeration technicians design, manufacture, sell, and service equipment to regulate interior temperatures. Technicians in this field often specialize in one area, such as refrigeration, and sometimes in a particular type of activity, such as research and development.

When working for firms that manufacture temperature-controlling equipment, technicians generally work in research and engineering departments, where they assist engineers and scientists in the design and testing of new equipment or production methods. For example, a technician may construct an experimental model to test its durability and operating characteristics. Technicians also work as sales workers for equipment manufacturers or dealers, and must be able to supply engineering firms and other contractors that design and install systems with information on installation, maintenance, operating costs, and the performance specifications of the equipment. Other technicians work for contractors, where they help design and prepare installation instructions for air-conditioning, heating, or refrigeration systems. Still others work in customer service, and are responsible for supervising the installation and maintenance of equipment. (See statement on refrigeration and air-conditioning mechanics elsewhere in the *Handbook*.)

Civil Engineering Technology. Technicians in this area assist civil engineers in planning, designing, and constructing highways, bridges, dams, and other structures. They often specialize in one area such as highway or structural technology. During the planning stage, they estimate costs, prepare specifications for materials, or participate in surveying, drafting, or designing. Once construction begins, they assist the contractor or superintendent in scheduling construction activities or inspecting the work to assure conformance to blueprints and specifications. (See statements on civil engineers, drafters, and surveyors elsewhere in the *Handbook.*)

Electronics Technology. Technicians in this field develop, manufacture, and service electronic equipment and systems. The types of equipment range from radio, radar, sonar, and television to industrial and medical measuring or control devices, navigational equipment, and electronic computers. Because the field is so broad, technicians often specialize in one area such as automatic control devices or electronic amplifiers. Furthermore, technological advancement is constantly opening up new areas of work. For example, the development of printed circuits stimulated the growth of miniaturized electronic systems.

When working in design, production, or customer service, electronic technicians use sophisticated measuring and diagnostic devices to test, adjust, and repair equipment. In many cases, they must understand the requirements of the field in which the electronic device is being used. In designing equipment for space exploration, for example, they must consider the need for minimum weight and volume and maximum resistance to shock, extreme temperature, and pressure. Some electronics technicians also work in technical sales, while others work in the radio and television broadcasting industry. (See statements on broadcast technicians and occupations in radio and television broadcasting elsewhere in the *Handbook.*)

Since technicians are part of a scientific team, they sometimes work under the supervision of engineers and scientists.

Industrial Production Technology. Technicians in this area, usually called industrial or production technicians, assist industrial engineers on problems involving the efficient use of personnel, materials, and machines to produce goods and services. They prepare layouts of machinery and equipment, plan the flow of work, make statistical studies, and analyze production costs. Industrial technicians also conduct time and motion studies (analyze the time and movements a worker needs to accomplish a task) to improve the production methods and procedures in manufacturing plants.

Many industrial technicians acquire experience that enables them to qualify for other jobs. For example, those specializing in machinery and production methods may move into industrial safety. Others, in job analysis, may set job standards and interview, test, hire, and train personnel. Still others may move into production supervision. (See statements on personnel workers and industrial engineers elsewhere in the *Handbook.*)

Mechanical Technology. Mechanical technology is a broad term that covers a large number of specialized fields including automotive technology, diesel technology, tool design, machine design, and production technology.

Technicians assist engineers in design and development work by making freehand sketches and rough layouts of proposed machinery and other equipment and parts. This work requires knowledge of mechanical principles involving tolerance, stress, strain, friction, and vibration factors. Technicians also analyze the costs and practical value of designs.

In planning and testing experimental machines and equipment for performance, durability, and efficiency,

technicians record data, make computations, plot graphs, analyze results, and write reports. They sometimes recommend design changes to improve performance. Their job often requires skill in the use of complex instruments, test equipment, and gauges, as well as in the preparation and interpretation of drawings.

When a product is ready for production, technicians help prepare layouts and drawings of the assembly process and of parts to be manufactured. They frequently help estimate labor costs, equipment life, and plant space. Some mechanical technicians test and inspect machines and equipment in manufacturing departments or work with engineers to eliminate production problems. Others are technical sales workers.

Tool designers are among the better known specialists in mechanical engineering technology. Tool designers prepare sketches of the designs for cutting tools, jigs, dies, special fixtures, and other devices used in mass production. Frequently, they redesign existing tools to improve their efficiency. They also make or supervise others in making detailed drawings of tools and fixtures.

Machine drafting, with some designing, is another major area often grouped under mechanical technology and is described in the statement on drafters. (Also see statements on mechanical engineers, automobile mechanics, manufacturers' sales workers, and diesel mechanics elsewhere in the *Handbook*.)

Instrumentation Technology. Automated manufacturing and industrial processes, oceanographic and space exploration, weather forecasting, satellite communication systems, environmental protection, and medical research have helped to make instrumentation technology a fast-growing field for technicians. They help develop and design complex measuring and control devices such as those in a spacecraft that sense and measure changes in heat or pressure, automatically record data, and make necessary adjustments. These technicians have extensive knowledge of physical sciences as well as electrical-electronic and mechanical engineering. (See statement on instrument workers elsewhere in the *Handbook*.)

Several areas of opportunity exist in the physical sciences:

Chemical technicians work with chemists and chemical engineers to develop, sell, and utilize chemical and related products and equipment.

Most chemical technicians do research and development, testing, or other laboratory work. They often set up and conduct tests on processes and products being developed or improved. For example, a technician may examine steel for carbon, phosphorus, and sulfur content or test a lubricating oil by subjecting it to changing temperatures. The technician measures reactions, analyzes the results of experiments, and records data that will be the basis for decisions and future research.

Chemical technicians in production generally put into commercial operation those products or processes developed in research laboratories. They assist in making the final design, installing equipment, and training and supervising operators on the production line. Technicians in quality control test materials, production processes, and final products to insure that they meet the manufacturer's specifications and quality standards. Many also work as technical sales personnel, selling chemicals or chemical products.

Many chemical technicians use computers and instruments, such as a dilatometer (which measures the expansion of a substance). Because the field of chemistry is so broad, chemical technicians frequently specialize in a particular industry such as food processing or pharmaceuticals. (See statements on chemists, chemical engineers, and occupations in the industrial chemical industry elsewhere in the *Handbook*.)

Meteorological technicians support meteorologists in the study of atmospheric conditions. Technicians calibrate instruments, observe, record, and report meteorological occurrences, and assist in research projects and the development of scientific instruments.

Geological technicians assist geologists in evaluating earth processes. Currently much research is being conducted in seismology, petroleum and mineral exploration, and ecology. These technicians install seismographic instruments, record measurements from these instruments, assist in field evaluation of earthquake damage and surface displacement, or assist geologists in earthquake prediction research. In petroleum and mineral exploration, they help conduct tests and record sound wave data to determine the likelihood of successful drilling, or use radiation detection instruments and collect core samples to help geologists evaluate the economic possibilities of mining a given resource.

Hydrologic technicians gather data to help hydrologists predict river stages and water quality levels. They monitor instruments that measure water flow, water table levels, or water quality, and record and analyze the data obtained. (See statement on environmental scientists elsewhere in the *Handbook*.)

Technician positions in the life sciences generally are classified into two categories:

Agricultural technicians work with agricultural scientists in the areas of food production and processing. Plant technicians conduct tests and experiments to improve the yield and quality of crops, or to increase resistance to disease, insects, or other hazards. Technicians in soil science analyse the chemical and physical properties of various soils to help determine the best uses for these soils. Animal husbandry technicians work mainly with the breeding and nutrition of animals. Other agricultural technicians are employed in the food industry as food processing technicians. They work in quality control or in food science research, helping food scientists develop better and more efficient ways of processing food material for human consumption. (See statement on food scientists elsewhere in the *Handbook*.)

Biological technicians work primarily in laboratories where they perform tests and experiments under controlled conditions. Microbiological technicians study microscopic or-

ganisms and may be involved in immunology or parasitology research. Laboratory animal technicians study and report on the reaction of laboratory animals to certain physical and chemical stimuli. They also study and conduct research to help biologists develop cures that may be applied to human diseases. Biochemical technicians assist biochemists in the chemical analysis of biological substances (blood, other body fluids, foods, drugs). Most of their work involves conducting experiments and reporting their results to a biochemist. As a biological technician, one might also work primarily with insects, studying insect control, developing new insecticides, or determining how to use insects to control other insects or undesirable plants. (See statements on life scientists elsewhere in the *Handbook*.)

Technicians also specialize in fields such as metallurgical (metal), electrical, and optical technology. In the atomic energy field, technicians work with scientists and engineers on problems of radiation safety, inspection, and decontamination. (See statement on occupations in the atomic energy field elsewhere in the *Handbook*.) New areas of work include environmental protection, where technicians study the problems of air and water pollution, and industrial safety.

Places of Employment

Over 585,000 persons worked as engineering and science technicians in 1976. Almost 400,000 worked in engineering fields, about 130,000 in the physical science occupations, and about 55,000 in the life sciences.

About two-thirds of all technicians worked in private industry. In the manufacturing sector, the largest employers were the electrical equipment, chemical, machinery, and aerospace industries. In nonmanufacturing, large numbers worked in wholesale and retail trade, communications, and in engineering and architectural firms.

In 1976, the Federal Government employed about 95,000 technicians, chiefly as engineering and electronics technicians, equipment specialists, biological technicians, cartographic technicians (mapmaking), meteorological technicians, and physical science technicians. The largest number worked for the Department of Defense; most of the others worked for the Departments of Transportation, Agriculture, Interior, and Commerce.

State government agencies employed nearly 50,000 engineering and science technicians, and local governments about 11,500. The remainder worked for colleges and universities and nonprofit organizations.

Training, Other Qualifications, and Advancement

Although persons can qualify for technician jobs through many combinations of work experience and education, most employers prefer applicants who have had some specialized technical training. Specialized training is available at technical institutes, junior and community colleges, area vocational-technical schools, extension divisions of colleges and universities, and vocational-technical high schools. Some engineering and science students who have not completed the bachelor's degree and others who have degrees in science and mathematics also are able to qualify for technician positions.

Persons also can qualify for technician jobs by less formal methods. Workers may learn through on-the-job training, apprenticeship programs, or correspondence schools. Some qualify on the basis of experience gained in the Armed Forces. However, postsecondary training is becoming increasingly necessary for advancement to more responsible jobs.

Some of the types of postsecondary and other schools that provide technical training are discussed in the following paragraphs:

Technical Institutes. Technical institutes offer training to qualify students for a job immediately after graduation with a minimum of on-the-job training. In general, students receive intensive technical training but less theory and general education than in engineering schools or liberal arts colleges. A few technical institutes and community colleges offer cooperative programs in which students spend part of the time in school and part in paid employment related to their studies.

Some technical institutes operate as regular or extension divisions of colleges and universities. Other institutions are operated by States and municipalities, or by private organizations.

Junior and Community Colleges. Curriculums in junior and community colleges which prepare students for technician occupations are similar to those in technical institutes, but with more emphasis on theory and liberal arts course work. After completing the 2-year programs, some graduates qualify for technician jobs while others continue their education at 4-year colleges. Most large community colleges offer 2-year technical programs, and many employers prefer graduates who have more specialized training.

Area Vocational-Technical Schools. These postsecondary public institutions serve students from surrounding areas and train them for jobs in the local area. Most of these schools require a high school degree or its equivalent for admission.

Other Training. Some large corporations conduct training programs and operate private schools to meet their needs for technically trained personnel in specific jobs; such training rarely includes general studies. Training for some technician occupations, for instance tool designers and electronic technicians, is available through formal 2- to 4-year apprenticeship programs. The apprentice gets on-the-job training under the close supervision of an experienced technician and related technical knowledge in classes, usually after working hours.

The Armed Forces have trained many technicians, especially in electronics. Although military job requirements generally are different from those in the civilian economy, military technicians often are able to find employment with only minimal additional training.

Technician training also is available from many private technical and correspondence schools that often

specialize in a single field such as electronics. Some of these schools are owned and operated by large corporations that have the resources to provide very up-to-date training in a technical field.

Those interested in a career as a technician should have an aptitude for mathematics and science and enjoy technical work. An ability to do detailed work with a high degree of accuracy is necessary; for design work, creative talent also is desirable. Since technicians are part of a scientific team, they sometimes must work under the close supervision of engineers and scientists as well as with other technicians and skilled workers. Some technicans, such as repair and maintenance technicians, should be able to deal effectively with customers requiring their services.

Engineering and science technicians usually begin work as trainees in routine positions under the direct supervision of an experienced technician, scientist, or engineer. As they gain experience, they receive more responsibility and carry out a particular assignment under only general supervision. Technicians may eventually move into supervisory positions. Those who have the ability and obtain additional education sometimes are promoted to positions as scientists or engineers.

Employment Outlook

Employment opportunities for engineering and science technicians are expected to be favorable through the mid-1980's. Opportunities will be best for graduates of postsecondary school technician training programs. Besides the openings resulting from the faster-than-average growth expected in this field, additional technicians will be needed to replace those who die, retire, or leave the occupation.

Industrial expansion and the increasing complexity of modern technology underlie the anticipated increase in demand for technicians. Many will be needed to work with the growing number of engineers and scientists in developing, producing, and distributing new and technically advanced products. Automation of industrial processes and growth of new areas of work such as environmental protection and urban development will add to the demand for technical personnel.

The anticipated growth of research and development expenditures in industry and government should increase requirements for technicians.

Because space and defense programs are major factors in the employment of technical personnel, expenditures in these areas affect the demand for technicians. The outlook for technicians is based on the assumption that defense spending will increase from the 1976 level by the mid-1980's, but will still be slightly lower than the levels of the late 1960's. If defense spending should differ substantially from this level, the demand for technicians would be affected accordingly.

Earnings

In private industry in 1976, average starting salaries for 2-year graduates ranged from about $9,000 to $10,800 a year, while those who did not complete a 2-year program earned average starting salaries from just over $6,400 to about $9,300. Senior engineering technicians in private industry earned average salaries of about $16,000 a year.

Starting salaries for all technicians in the Federal Government were fairly uniform in 1977. A high school graduate with no experience could expect $6,572 annually to start. With an associate degree, the starting salary was $8,316, and with a bachelor's, $9,303 or $11,523. At higher experience levels, however, differences in earnings are significant. The average annual salary for all engineering technicians employed by the Federal Government in 1977 was $17,800; for physical science technicians, $17,100; and for life science technicians, about $11,400.

Sources of Additional Information

For information on careers for engineering and science technicians and engineering and technology programs, contact:

Engineers Council for Professional Development, 345 East 47th St., New York, N.Y. 10017.

Information on schools offering technician programs is available from:

National Association of Trade and Technical Schools, Accrediting Commission, 2021 L St. NW., Washington, D.C. 20036.

U.S. Department of Health, Education, and Welfare, Office of Education, Washington, D.C. 20202.

State departments of education also have information about approved technical institutes, junior colleges, and other educational institutions within the State offering post-high school training for specific technical occupations. Other sources include:

American Association of Community and Junior Colleges, Suite 410, 1 Dupont Circle, Washington, D.C. 20036.

National Home Study Council, 1601 18th St. NW., Washington, D.C. 20009.

SURVEYORS

(D.O.T. 018.188)

Nature of the Work

Before engineers can plan highways or other construction projects, they need complete and accurate information about boundaries, land features, and other characteristics of the construction site. Surveyors measure construction sites, help establish official land boundaries, assist in setting land valuations, and collect information for maps and charts.

Surveyors often work as party chiefs; that is, they are in charge of a field party that determines the precise measurements and locations of elevations, points, lines, and contours on the earth's surface, and distances between points. Surveyors are directly responsible for the field party's activity and the accuracy of its work. They plan the field work, select survey reference points, and determine the precise location of natural and manmade features of the survey region. They record the information disclosed by the survey, ver-

ify the accuracy of the survey data, and prepare sketches, maps, and reports.

A typical field party is made up of the party chief and three to six assistants and helpers. *Instrument workers* (D.O.T. 018.188) adjust and operate surveying instruments such as the theodolite (used to measure altitude) These workers also compile notes, sketches, and records of the data obtained from using these instruments. *Chain workers* (D.O.T. 018.687) use a steel tape or surveyor's chain to measure distances between surveying points. Generally chain workers operate in pairs, one holding the tape at the last established point, and the other marking an advanced measuring point. Chain workers also may mark measured points with painted stakes. *Rod workers* (D.O.T. 018.587) use a level rod, range pole, or other equipment to assist instrument workers in determining elevations, distances, and directions. They hold and move the range pole according to hand or verbal signals of the instrument worker to help establish the exact point of measurement. Rod workers also may clear brush from the survey line.

Surveyors often specialize in a particular type of survey. Besides doing *highway surveys*, many perform *land surveys* to locate boundaries of a particular tract of land. They then prepare maps and legal descriptions for deeds, leases, and other documents. Surveyors doing *topographic surveys* determine elevations, depressions, and contours of an area, and indicate the location of distinguishing surface features such as farms, buildings, forests, roads, and rivers. Other specialties include mining, pipeline, gravity, and magnetic surveying.

Several closely related occupations are geodesy and photogrammetry. Geodesists measure immense areas of land, sea, or space by taking into account the earth's curvature and its geophysical characteristics. (See statement on geophysicists elsewhere in the *Handbook*.) Photogrammetrists measure and interpret photographic images to determine the various physical characteristics of natural or manmade features of an area. By applying analytical processes and mathematical techniques to photographs obtained from aerial, space, ground, and underwater locations, photogrammetrists are able to make detailed maps of areas that are inaccessible or difficult to survey by other methods. Control surveys on the ground are made to determine the accuracy of maps derived from photogrammatic techniques.

Surveyors doing topographic surveys to determine elevations, depressions, and contours of an area.

Places of Employment

About 52,000 persons worked as surveyors in 1976. Federal, State, and local government agencies employ about 3 out of every 10 surveyors. Among the Federal Government agencies employing these workers are the U.S. Geological Survey, the Bureau of Land Management, the Army Corps of Engineers, and the Forest Service. Most surveyors in State and local government agencies work for highway departments and urban planning and redevelopment agencies.

A large number of surveyors work for construction companies and for engineering and architectural consulting firms. A sizable number either work for or own firms that conduct surveys for a fee. Significant numbers of surveyors also work for crude petroleum and natural gas companies, and for public utilities.

Training, Other Qualifications, and Advancement

Most persons prepare for surveying work by combining postsecondary school courses in surveying and extensive on-the-job training. Some prepare by obtaining a college degree. Junior and community colleges, technical institutes, and vocational schools offer 1-, 2-, and 3-year programs in surveying. A few 4-year colleges offer bachelor's degrees specifically in surveying, while many others offer several courses in the field.

High school students interested in pursuing a career in surveying should take courses in algebra, geometry, trigonometry, drafting, and mechanical drawing.

High school graduates with no formal training in surveying usually start as rod workers. After several years of on-the-job experience and some formal training in surveying, it is possible to advance to chain worker, instrument worker, and finally to party chief.

Beginners with postsecondary school training in surveying can generally start as instrument workers. After gaining experience, they usually advance to party chief, and may later seek to become a registered surveyor. In many instances, promotions to higher level positions are based on written examinations as well as experience.

For those interested in a career as a photogrammetrist, a bachelor's degree in engineering or the physical sciences is usually needed. Most photogrammetry technicians have had some specialized postsecondary school training.

All 50 States require licensing or registration of land surveyors responsible for locating and describing land boundaries. Registration requirements are generally quite strict, because once registered, surveyors can be held legally responsible for their work. Requirements for licensure vary among the States but in general they include a combination of 3 to 8 years' experience in surveying and

passing an examination. A few States now require a bachelor's degree, emphasizing surveying, as a prerequisite to licensure.

In 1976, about 23,000 land surveyors were registered. In addition, about 13,500 engineers were registered to do land surveying, primarily as part of their civil engineering duties; however, these workers are considered engineers rather than surveyors. (See statement on civil engineers elsewhere in the *Handbook*.)

Surveyors should have the ability to visualize and understand objects, distances, sizes, and other abstract forms. Also, because surveying mistakes can be very costly, surveyors must perform mathematical calculations quickly and accurately while paying close attention to the smallest detail. Leadership qualities also are important as surveyors must supervise the work of others.

Members of a survey party must be in good physical condition in order to work outdoors and carry equipment over difficult terrain. They also need good eyesight, coordination, and hearing in order to communicate over great distances by hand signals or voice calls.

Employment Outlook

Employment of surveyors is expected to grow faster than the average for all occupations through the mid-1980's. In addition to the openings resulting from growth, many will result from the need to replace those who die, retire, or transfer to other fields of work.

The rapid development of urban areas and increased land values should create jobs for surveyors to locate boundaries for property records. Others will be needed to lay out streets, shopping centers, housing developments, and recreation areas. Construction and improvement of the Nation's roads and highways also will require many new surveyors. However, periods of slow construction activity could limit the demand for surveyors at those particular times.

Continuing expansion of technician and technology programs in postsecondary schools will create a need for more surveying teachers.

Earnings and Working Conditions

In the Federal Government in 1977, high school graduates with little or no training or experience started as rod workers or chain workers with an annual salary of $6,572. Those with 1 year of related postsecondary training earned $7,408. Those with an associate degree that included courses in surveying generally started as instrument workers with an annual salary of $8,316. The majority of surveyors who worked as party chiefs in the Federal Government earned between $10,000 and $14,000 per year and some high-level positions earned more than $17,000 per year.

Although salaries in private industry vary by geographic area, limited data indicate that salaries are generally comparable to those in Federal service and are above the average earnings of nonsupervisory workers in private industry, except farming.

Surveyors usually work an 8-hour, 5-day week. However, they sometimes work longer hours during the summer months when weather conditions are most suitable for surveying. The work of surveyors is active and sometimes strenuous. They often stand for long periods and walk long distances or climb hills with heavy packs of instruments and equipment. Because most work is out-of-doors, surveyors are exposed to all types of weather. Some duties, such as planning surveys, preparing reports and computations, and drawing maps, usually are done in an office.

Sources of Additional Information

Information about training and career opportunities in surveying is available from:

American Congress on Surveying and Mapping, 210 Little Falls St., Falls Church, Va. 22046.

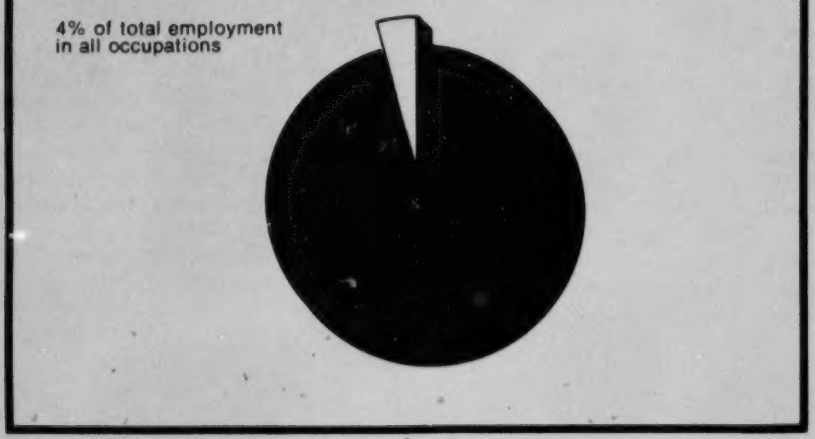
General information on careers in photogrammetry is available from:

American Society of Photogrammetry, 105 North Virginia Ave., Falls Church, Va. 22046.

MECHANICS AND REPAIRERS

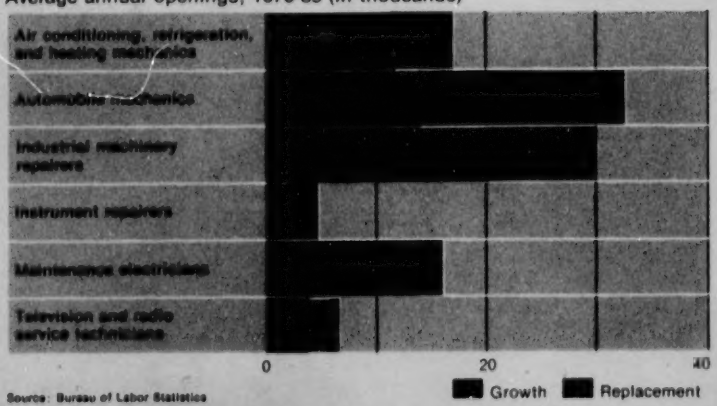
In the technologically advanced society we live in today, mechanical equipment of one type or another touches almost all aspects of our lives. Transportation equipment such as cars, trucks, buses, and airplanes carries both goods and people anywhere in the world. Telephones and other communication equipment enable messages to be conveyed quickly and efficiently. Household appliances and machinery such as air-conditioners make our lives easier and more comfortable. The approximately 3 million people who worked as mechanics and repairers in 1976 performed the vital function of keeping these and other types of machinery running and in good working order.

Mechanics and repairers, 1976



Mechanic and repairer occupations offer many career opportunities to persons who are mechanically inclined

Selected mechanic and repairer occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

Of the mechanics and repairers employed in 1976, more than one-third worked on motor vehicles in occupations such as automobile mechanic, truck or bus mechanic, and automobile body repairer. Some other large occupations—each employing more than 100,000 workers—were appliance repairer, industrial machinery repairer, airplane mechanic, and television and radio service technician. Employment in some occupations, including vending machine mechanic, electric sign repairer, and locksmith, was relatively small.

In addition to the nearly 3 million mechanics and repairers employed in 1976, almost 700,000 people worked in three related occupations: Maintenance electrician, telephone craftworker, and watch repairer. Altogether these 3.7 million maintenance and repair workers represented about 1 out of every 3 skilled workers.

Almost one-fourth of the mechanics and repairers worked in manufacturing industries—the majority in plants that produce durable goods such as steel, automobiles, and aircraft. About one-fifth worked in retail trade—mainly in firms that sell and service automobiles, household appliances, farm implements, and other mechanical equipment. Another one-fifth worked in shops that service such equipment. Most of the re-

4 03

maining mechanics and repairers worked for transportation, construction, and public utilities industries, and all levels of government.

Mechanics and repairers work in every section of the country, but most employment opportunities are in populous and industrialized areas.

Training, Other Qualifications, and Advancement

Many mechanics and repairers learn their skills on the job or through apprenticeship training. Some acquire basic training or increase their skills in vocational and technical schools; others take correspondence courses. Training and experience in the Armed Forces also may help people prepare for some of these occupations, including television and radio service technician, airplane mechanic, and telephone craftworker.

Most employers consider a 3- to 4-year apprenticeship, supplemented each year by at least 144 hours of related classroom instruction in courses such as mathematics, physics, and basic economics, as the best way to learn skilled maintenance and repair work. Formal apprenticeship agreements are registered with a State apprenticeship agency or the U.S. Department of Labor's Bureau of Apprenticeship and Training.

Employers look for applicants who have mechanical aptitude and like to work with their hands. Many employers prefer people whose hobbies or interests include automobile repair, model building, or radio and television repair. A high school education often is required, and employers generally prefer applicants who have had courses in mathematics, chemistry, physics, blueprint reading, and machine shop.

Physical requirements for work in this field vary greatly among occupations. For example, telephone lineworkers should be strong and agile to climb poles, lift heavy equipment, and work in awkward positions. Instrument and watch repairers need patience, finger dexterity, and good vision.

Many maintenance and repair workers advance to supervisory jobs; others to sales or technician jobs. Some open their own businesses.

Employment Outlook

Employment in maintenance and repair occupations as a whole is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs created by employment growth, many thousands of openings will arise in this relatively large occupational category as experienced workers retire, die, or transfer to other fields.

Many factors are expected to contribute to the growing need for mechanics and repairers, including increased demand for household appliances, automobiles, and other items, and repair of complex machinery in industry.

This chapter includes statements on many maintenance and repair occupations. Other maintenance and repair workers are discussed in other sections of the *Handbook*. For example, airplane mechanics are discussed with air transportation occupations and millwrights with industrial production and related occupations.

TELEPHONE CRAFT OCCUPATIONS

More than 1 out of every 3 employees in the telephone industry is a craft worker who installs, repairs, and maintains phones, cables, and related equipment. This chapter discusses the four groups of telephone craft occupations: Central office craft occupations, central office equipment installers, line installers and cable splicers, and telephone installers and repairers.

CENTRAL OFFICE CRAFT OCCUPATIONS

Nature of the Work

Telephone companies employed about 135,000 craft workers in 1976 to maintain and repair the complex equipment in their central offices. Most worked as frame wirers, central office repairers, and trouble locators. In small telephone companies, central office craft workers must perform a variety of jobs, but most specialize in one of these three areas.

Frame wirers (D.O.T. 822.884) connect and disconnect wires that run from telephone lines and cables to equipment in central offices. This equipment consists of a frame having many terminal lugs mounted on it, each of which is assigned a specific telephone number. It also contains one pair of wires for each customer's telephone that is connected to that central office. To connect a new telephone, the frame wirer solders the customer's pair of wires to a set of terminal lugs. To disconnect a telephone, a frame wirer melts off the solder and removes the wires from the terminal. Frame wirers occasionally change a customer's phone number. This is done by reconnecting the customer's pair of wires to a different set of terminal lugs.

Central office repairers (D.O.T. 822.281) maintain the switching equipment that automatically connects lines when customers dial numbers. Electromechanical switching systems contain moving parts that must be cleaned and oiled periodically. Also, electronic switching circuits must be checked occasionally for breakages.

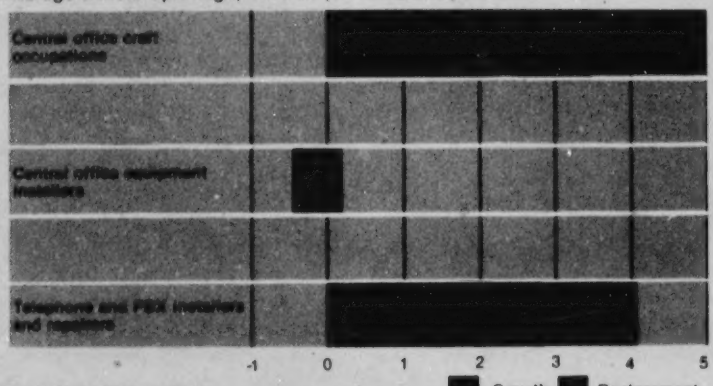
When customers report trouble with their telephones, *trouble locators* (D.O.T. 822.381) work at special switchboards to find the source of the problem. To do this, they communicate with telephone installers and repairers as they attempt to make connections from a portable telephone through the customer's service line to the central office. The trouble shooter locates the problem by having the telephone repairer connect the portable phone at various places on the customer's line until a connection can be made through to the central office. If the problem is found to be at the central office, the trouble locator repeats this procedure with a central office repairer. In addition, trouble locators must also test new equipment when it is installed to make sure installations are made correctly. They also work with other employees, such as central office repairers and cable splicers, who help find the cause of trouble and make repairs.

Training, Other Qualifications, and Advancement

Telephone companies give classroom instruction and on-the-job training to new central office craft employees. In addition, telecommunications equipment manufacturers often train central office craft workers in the use, maintenance, and repair of equipment that they sell to telephone companies. Some vocational schools, particularly those in rural areas served by small independent telephone companies, also offer training to persons interested in becoming central office craft workers. A few people may learn these crafts through apprenticeship programs designed by State employment agencies in conjunction with local telephone companies. Often classrooms are supplied with equipment similar to that which the trainee will be using on the job.

Telephone craft occupations will offer relatively few openings

Selected telephone craft occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics

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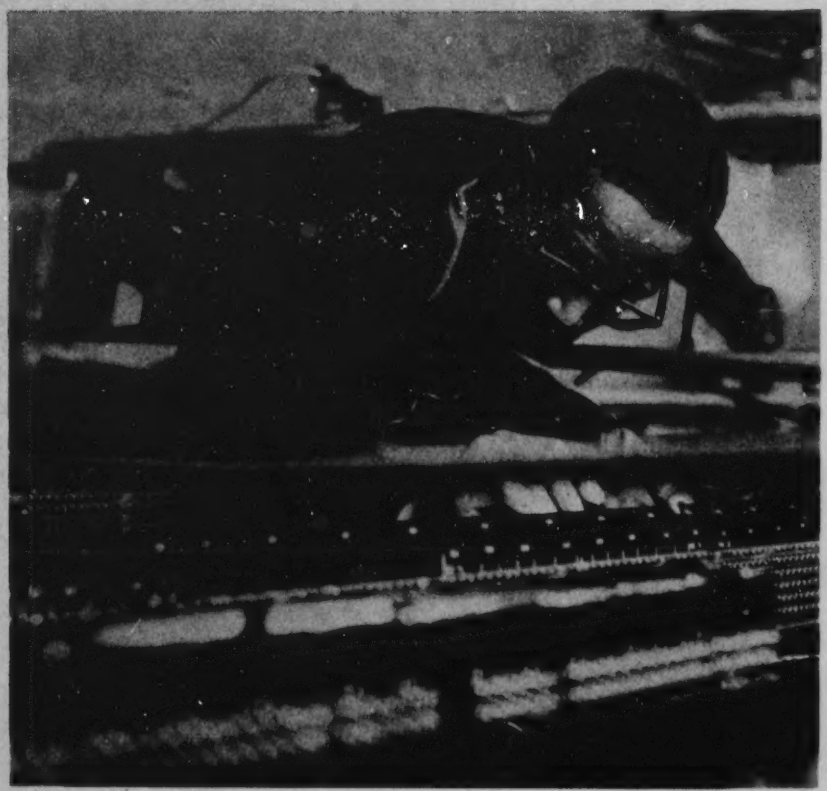


Frame wirer makes connection for new telephone.

Trainee jobs generally are filled by employees already with the company, such as telephone operators or line installers. Occasionally workers are hired from outside. Usually, trainees are assigned to the starting job of frame wirer, and take basic courses in telephone communications. They gain practical experience by observing and helping experienced frame wirers under the direction of supervisors. With additional training and experience, a frame wirer can advance to central office repairer or trouble locator. Usually it takes at least 5 years for an inexperienced worker to advance to the top pay rate in either of these two jobs.

Since electrical wires are usually color coded, persons who are considering careers in central office crafts should not be color blind. They also should be able to work closely with others, because teamwork often is essential in solving complex problems. A basic knowledge of electricity and electronics and telephone training in the Armed Forces are helpful.

Telephone companies give central office craft employees continued training throughout their careers to keep them abreast of the latest developments. As new types of equipment and tools and new maintenance methods are introduced, employees are sent to schools to learn about them.

Central office craft workers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment in central office craft occupations is expected to increase about as fast as the average for all occupations through the mid-1980's. Many new central offices will be built to meet the expected increase in demand for telephone services. Older, outdated central offices will be remodeled to include improved electronic switching systems (ESS). As population grows and becomes more mobile, a greater demand for telephone installations and removals will result in employment growth for frame wirers, trouble locators, and central office repairers. Additional employment growth for trouble locators and central office repairers will result from the use of increasingly complex equipment which requires more maintenance. Also, newer and more complex central office equipment will require more testing when installed, thus increasing the demand for trouble locators.

In addition to employment growth, many job openings will arise from the need to replace experienced workers who retire, die, or transfer to other occupations. Retirements and deaths alone may result in several thousand openings each year. Although most job openings are filled by the advancement of operators and other workers already employed by telephone companies, some trainee positions as frame wirers should be available for new employees. Most job openings will be in metropolitan areas.

Earnings and Working Conditions

In late 1976, average hourly rates were $7.24 for trouble locators and $6.95 for central office repairers. By comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

Earnings increase considerably with length of service. Under the terms of a major union contract in effect in late 1976, frame wirers started at $4.68 an hour and could work up to a maximum of $7.03 an hour after 4 years. Central office repairers and trouble locators could earn a maximum of $8.34 an hour after 5 years.

Employees in central offices work in clean and well-lighted surroundings. Since the telephone industry gives continuous service to its customers, central offices operate 24 hours a day, 7 days a week. Some central office craft workers, therefore, have work schedules that include shift work and some weekends

and holiday work for which they receive extra pay. Central office craft workers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

CENTRAL OFFICE EQUIPMENT INSTALLERS

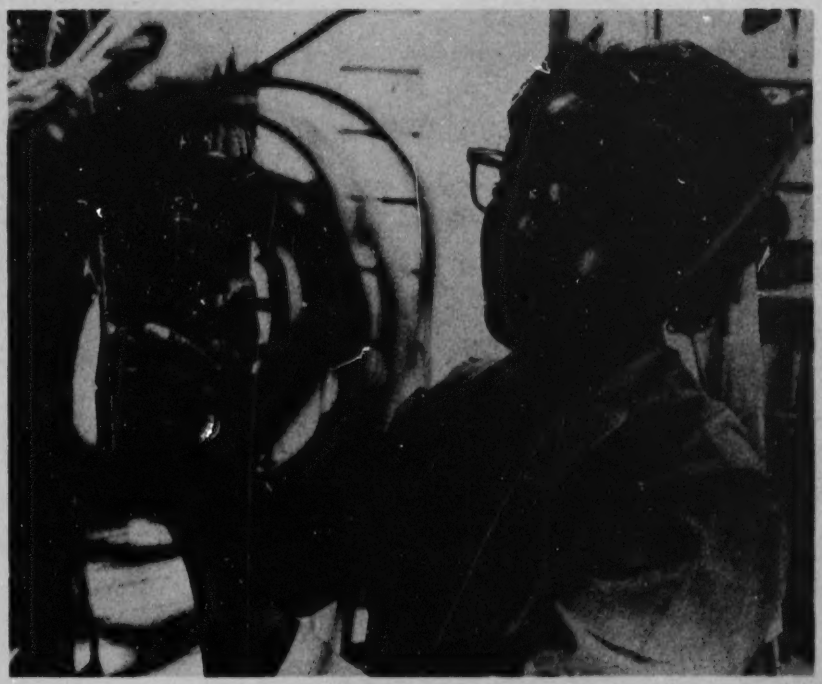
(D.O.T. 822.381)

Nature of the Work

Central office equipment installers set up the complex switching and dialing equipment used in central offices of telephone companies. They may install equipment in new central offices, add equipment in an expanding office, or replace outdated equipment.

On a job, installers follow blueprints, diagrams, and floor plans in order to position the equipment properly and wire it correctly. They often use hoists to lift heavy items into place and use handtools, such as screwdrivers or soldering guns, to connect equipment once it is in place. Recently developed equipment sometimes comes in preassembled components and often requires only simple plug-in connections.

After the new equipment has been put in place, installers connect the outgoing and incoming telephone trunklines, often consulting diagrams to ensure that connections are made correctly. Once this is completed, installers then test the system, using electrical testing equipment, such as electrical pulse repeaters and ohmmeters, to measure the strength and consistency of the current flow. If installers discover that the system is not functioning properly, they must check the equipment and all connections to determine the cause, and then correct it.



Installer wires a new distribution frame and switching equipment.

Places of Employment

About 20,000 installers were employed in 1976. Most worked for manufacturers of central office equipment. Others worked directly for telephone companies or for private contractors who specialize in large-scale installations.

Most central office equipment installers work in metropolitan areas, where large central offices are found. Hundreds of installers may be required to work on large jobs such as a long-distance toll center in a big city. Other installers are assigned areas that include several States, and therefore they must travel frequently to small towns within their area. Installing equipment in small communities often requires only 2 or 3 installers.

Training, Other Qualifications, and Advancement

Individuals considering careers as central office equipment installers should have good eyesight and, since electrical wires are generally color coded, should not be color blind. They should be able to work with others, for teamwork often is essential to solving a complex problem. Although manufacturers generally provide all the necessary training to perform this job, courses in blueprint reading and electronic theory are helpful to those interested in this career.

New employees attend classes the first few weeks to learn basic installation and then begin on-the-job training. Often trainees will be transported to the plant where the equipment is manufactured to receive their training.

Workers who have several years of experience may qualify as skilled installers. Training continues, however, even after they become skilled; additional courses are given from time to time to improve skills and to teach new techniques in installing telephone equipment. Also, technological innovations are constantly resulting in changes in equipment. When manufacturers develop new equipment, installers must be trained to install it.

Installers who have managerial ability can advance to supervisory positions.

Employment Outlook

Employment of central office equipment installers is expected to decline through the mid-1980's. However, a few hundred openings will arise each year to replace experienced installers who transfer to other work, retire, or die.

Thousands of new central offices will be constructed in the next decade. In addition, in older offices obsolete manual and dial switching equipment will be replaced with more efficient electronic switching systems (ESS). However, most new central office equipment will be manufactured in components that come partially assembled, thus greatly reducing the time needed for installation. The greater complexity of ESS's will require more testing of new equipment, but this will not offset the time savings resulting from the use of component parts.

Employment may fluctuate from year to year, however, because investment in central office equipment is subject to changes in business conditions and availability of funds. Thus, when business is prospering, installations and modifications of central offices may occur at an above-average pace. When the business outlook is depressed, there is less likelihood that new central offices will be built or that existing offices will be enlarged or modernized.

Earnings and Working Conditions

Under the terms of a major union contract in effect in late 1976, covering most central office equipment installers, starting rates for inexperienced installers ranged from $3.73 to $4.71 an hour. The contract provided for periodic increases, and employees could reach rates of $7.20 to $8.34 an hour after 5 years of experience. Travel and expense allowances also were provided.

The Communications Workers of America represents most central office equipment installers, including those with the Bell System. The International Brotherhood of Electrical Workers represents some installers employed by various telephone companies, by manufacturers supplying the independent segment of the telephone industry, and by large installation contractors.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

LINE INSTALLERS AND CABLE SPLICERS

Nature of the Work

The vast network of wires and cables that connect telephone central offices to each other and to customers' telephones and switchboards is constructed and maintained by line installers and cable splicers and their helpers. Telephone companies employed almost 55,000 of these workers in 1976 including about 33,000 cable splicers, 15,000 line installers, and 7,000 helpers, laborers, and other workers.

To construct new telephone lines, *line installers* (D.O.T. 822.381) place wires and cables that lead from the central office to customers' premises. They use power-driven equipment to dig holes and set in telephone poles which support cables. Line installers climb the poles to attach the cables, usually leaving the ends free for cable splicers to connect later. In cities where telephone lines are below the streets, installers place cables in underground conduits. On construction jobs, installers work in crews of two persons or more. A supervisor directs the work of several crews.

When wires or cables break or a pole is knocked down, line installers often are called upon to make emergency repairs. These repairs are most common in parts of the country that have hurricanes, tornadoes, and heavy snowfalls. The line crew supervisor keeps in radio contact with the central office, which directs the crew to problem locations on the lines. Some installers periodically inspect sections of lines in rural areas and make minor repairs.

After line installers place cables on poles or in underground conduits, *cable splicers* (D.O.T. 829.381) generally complete the line connections. Splicers work on poles, on aerial ladders and platforms, in manholes, or in basements of large buildings. They connect individual wires within the cable and rearrange wires when lines have to be changed. At each splice, they either wrap insulation around the wires and seal the joint with a lead sleeve or cover the splice with some other type of closure. Usually, they fill the cable sheathing with compressed air to keep out moisture.

Splicers also install terminal boxes that connect customers' telephones to outside cables. An innovation in telephone connecting, these terminal boxes are often placed in the basements of apartment buildings or other buildings containing multiple telephone customers. When a telephone installer wishes to connect or disconnect a customer's telephone, it can be done quickly at the terminal box.

Splicers also maintain and repair cables. The preventive maintenance work that they do is extremely important, because a single defect in a cable may cause a serious interruption in service. Many trouble spots are located through air pressure or electric tests.

Training, Other Qualifications, and Advancement

Telephone companies hire inexperienced workers to train for jobs as line installers or cable splicers. Knowledge of the basic principles of electricity and training in installing telephone systems with the Armed Forces are helpful. Physical examinations usually are given to prospective employees, since some line and cable work is strenuous, requiring workers to climb poles and lift heavy cables and equipment. The ability to distinguish colors is necessary because wires usually are coded by color.

Telephone companies have training programs for line installers and

Telephone companies hire inexperienced workers to train for jobs as line installers or cable splicers.

cable splicers that include classroom instruction as well as on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, cable supporting clamps, and other fixtures to simulate working conditions as closely as possible. Trainees learn to climb poles and are taught safe working practices to avoid falls and contact with power wires. After a short period of classroom training, some trainees are assigned to a crew to work with experienced line installers and cable splicers under the supervision of a line supervisor.

In addition to the training provided by the telephone companies, some manufacturers of cable installation equipment also train line installers and cable splicers in the use of equipment that the manufacturers sell to telephone companies. Often a telephone company will send its line and cable workers to the manufacturer's training school. At other times manufacturers send their instructors to the job site.

Some small independent telephone companies, particularly those in rural areas, do not have adequate facilities to train their employees. Therefore, they may rely on local vocational and technical schools to provide classroom training to craft employees. A few apprenticeships also are available for line and cable workers. In these cases, employees receive classroom training in courses such as mathematics and electronic theory sponsored by outside agencies, for example State employment agencies, while they receive on-the-job training. Apprenticeships generally last 4 years.

Line installers and cable splicers continue to receive training throughout their careers, to qualify for more difficult assignments and to keep up with technological changes. Due to the strenuous nature of the job, most line installers and cable splicers find it necessary to transfer to other occupations as they advance in age. Those having the necessary qualifications find many additional advancement opportunities in the telephone industry. For example, a line installer, may be transferred to telephone installer and later to telephone repairer or other higher rated job.

Employment Outlook

Employment of cable splicers is expected to show little or no change through the mid-1980's. Technological developments such as the telephone splicing van which uses the truck engine to heat and ventilate manholes and drive power tools and equipment will improve the efficiency of splicers, thus limiting the need for additional workers. Nevertheless, many job openings will arise due to the need to replace experienced splicers who retire, die, or transfer to other occupations.

Little or no change is expected in the number of line installers because the increasing use of mechanical improvements such as plows that can dig a trench, lay cable, and cover it in a single operation have eliminated much of the heavier physical work of the line crews and have caused reductions in crew size. Also, satellites are expected to carry an increasing volume of telephone traffic, thus slightly reducing the emphasis on cable installation. On the other hand, as urban and suburban areas expand outward, some employment opportunities for line installers and cable splicers may be created by the desire to place unsightly cables under-

ground in localities where cables presently are hung from poles. In addition, some job openings will occur as experienced line installers retire, die, or transfer to other occupations.

Due to the many miles of cable which must be installed and maintained in rural areas, job openings for line installers and cable splicers may be easier to find in small cities than in metropolitan areas.

Earnings and Working Conditions

In late 1975, wage rates of cable splicers averaged $6.86 an hour, line installers averaged $6.49, and cable splicers' helpers, $5.46. By comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

Pay rates for cable splicers and line installers depend to a considerable extent upon length of service and geographic location. For example, under the terms of a major union contract in effect in late 1976, new workers in line construction jobs in the highest pay-scale cities began at $4.71 an hour and could reach a maximum of $8.34 after 5 years of service. The maximum hourly rate for cable splicers also was $8.34. Line installers and cable splicers are covered by the same contract provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Line installers and cable splicers work outdoors. They must do considerable climbing, and often work in stooped and cramped positions. Safety standards, developed over the years by telephone companies with the cooperation of labor unions, have greatly reduced the hazards of these occupations. When severe weather damages telephone lines, line installers and cable splicers may be called upon to work long and irregular hours to restore service.

See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.

TELEPHONE AND PBX INSTALLERS AND REPAIRERS

Nature of the Work

About 1 in every 3 telephone craft workers is a telephone installer or repairer. About 110,000 were employed in 1976. They install and service telephones and switchboard systems such as PBX and CENTREX on customers' property and make repairs on the equipment when trouble develops. These workers generally travel to customers' homes and offices in trucks equipped with telephone tools and supplies. When customers move or request new types of service, they relocate telephones or make changes on existing equipment. For example, they may install a switchboard in an office, or change a two-party line to a single-party line in a residence. Installers also may fill a customer's request to add an extension in another room, or to replace an old telephone with a new model. Most installers and repairers specialize in one or two of the jobs described below; however, installers and repairers employed at small telephone companies may perform all of these jobs.

Telephone installers (D.O.T. 822.381) install and remove telephones in homes and business places. They connect telephones to outside service wires and sometimes must climb poles to make these connections. Occasionally, especially in apartment buildings, the service wires or terminals are in the basement of the building in which the installation or removal is being done. Telephone installers are sometimes called station installers.

PBX installers (D.O.T. 822.381) perform the same duties as telephone installers, but they specialize in more complex telephone system installations. They connect wires from terminals to switchboards and make tests to check their installations. Some PBX installers also set up equipment for mobile radiotelephones, data processing equipment, and telephone switchboard systems for radio and television broadcasts that involve receiving phone calls from the audience.

Telephone repairers (D.O.T. 822.281), with the assistance of trouble locators in the central office, locate trouble on customers' equipment. A repairer finds the source of the problem by connecting a portable telephone to the customer's telephone cord and then dialing the trouble locator in the central office. If the proper connection is made, the problem is in the customer's telephone. If a connection cannot be completed, the problem is in the service line between the phone and the central office, and the repairer repeats this procedure at various points along the service line until the problem is located. The repairer then makes the necessary repairs to restore service.

PBX repairers (D.O.T. 822.281), with the assistance of trouble locators, locate trouble on customers' PBX, CENTREX, or other complex telephone systems and make the necessary repairs. They also maintain associated equipment such as batteries, relays, and power plants. Some PBX repairers maintain and repair equipment for radio and television broadcasts, mobile radiotelephones, and data processing equipment.

Training, Other Qualifications, and Advancement

Telephone companies give new service workers classroom instruction in subjects such as mathematics and electrical and electronic theory. Trainees supplement their classroom instruction with on-the-job training. Often additional training is conducted in classroom set-ups that simulate actual working conditions. For example, telephone installer trainees are instructed in classrooms equipped with telephone poles, lines and cables, terminal boxes, and other equipment. They practice installing telephones and connecting wires just as they would on the job. After a few weeks in the classroom, trainees are assigned to the field for on-the-job training by experienced workers, often supervisors.

Many small independent telephone companies, especially those located in rural areas, do not have

the facilities, such as simulated classrooms, necessary to train their employees. Therefore, vocational and technical schools may provide training for installers and repairers employed by telephone companies in the area. A few installers and repairers may enter apprenticeship programs conducted jointly by State employment agencies and telephone companies. In these programs apprentices receive on-the-job training at the company where they are employed. At the same time, they receive classroom instruction from the State agencies. Generally apprenticeships last 4 years.

Because telephone wires usually are color-coded, applicants must have good eyesight—no color blindness. Physical examinations are sometimes required since the work may involve strenuous activity such as climbing poles. In addition, applicants may have to pass a test designed to determine the applicant's aptitude for the job. Often trainees are chosen from current telephone company employees, such as operators or line installers.

Telephone service workers continue to receive training throughout their careers to qualify for more responsible assignments and to keep up with technical changes. Those who have managerial ability can advance to supervisory jobs.

Employment Outlook

Employment of telephone installers and repairers is expected to increase about as fast as the average for all occupations through the mid-1980's. Most job openings will result from employment growth, but many openings will arise from the need to replace workers who retire, die, or transfer to other occupations. These openings usually are filled by workers from other telephone jobs, such as operators, service representatives, line installers, or cable splicers, but some should be available to new employees.

Employment will increase due to the growing demand for telephones and PBX and CENTREX systems. Employment of installers will increase most rapidly in areas where the population is growing rapidly, thus creating a large demand for telephone installations. Also, areas that have a large influx or outflow of people, such as those with military bases or colleges nearby, will have a relatively large demand for telephone installations and removals.

Employment of telephone installers will increase most rapidly in areas where the population is growing rapidly.

On the other hand, technological improvements may limit the demand for installers and repairers. For example, terminal boxes allow a number of installations to be connected at one central location and make it unnecessary for installers to climb telephone poles.

Earnings and Working Conditions

In late 1975, the average hourly rate for PBX repairers was $7.01, and the average for telephone and PBX installers was $6.75. In comparison, nonsupervisory workers in all private industries, except farming, had average earnings of $4.87 an hour.

Earnings increase considerably with length of service. Under the terms of a major union contract in

effect in late 1976, in one of the higher pay-scale cities, telephone installers and repairers earned a starting rate of $4.49 an hour, with periodic pay increases up to a maximum of $7.63 an hour after 4 years of service. Installers and repairers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally.

Telephone installers and repairers work indoors and outdoors in all kinds of weather. They may work extra hours when breakdowns occur in lines or equipment.

(See the statement on the telephone industry elsewhere in the *Handbook* for sources of additional information and for general information on fringe benefits.)

OTHER MECHANICS AND REPAIRERS

AIR-CONDITIONING, REFRIGERATION, AND HEATING MECHANICS

(D.O.T. 637.281 and .381, 862.281 and .381, and 869.281)

Nature of the Work

Heating and air-conditioning equipment makes buildings comfortable for work, study, or play. Refrigeration equipment makes it possible to safely store food, drugs, and other items. The types of equipment that provide these conveniences are complex. Air-conditioning, refrigeration, and heating mechanics are the skilled workers who install, maintain, and repair them. These workers usually specialize in one area but often have the ability to work in several.

Air-conditioning and refrigeration mechanics (D.O.T. 637.281 and .381) install and repair equipment ranging in size from small window units to large central air-conditioning or refrigeration systems. When installing new equipment, they put the motors, compressors, evaporators, and other components in place, following blueprints and design specifications. They connect duct work, refrigerant lines, and other piping and then connect the equipment to an electrical power source. After completing the installation, they charge the system with refrigerant and check it for proper operation.

When air-conditioning and refrigeration equipment breaks down, mechanics diagnose the cause and make repairs. When looking for defects they inspect components such as relays and thermostats.

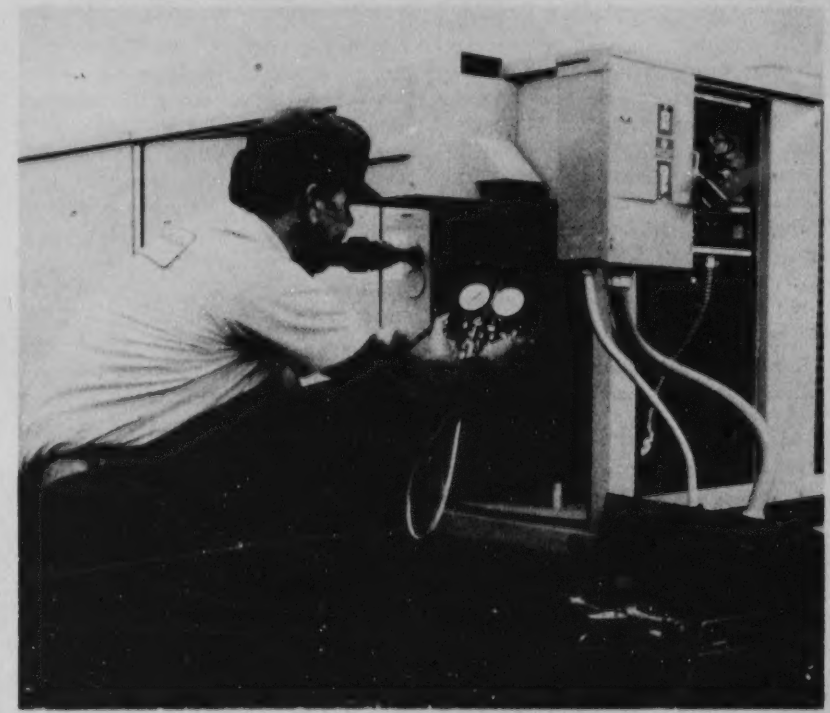
Furnace installers (D.O.T. 862.381 and 869.281), also called heating equipment installers, follow blueprints or other specifications to install oil, gas, and electric heating units. After setting the heating unit in place, they install fuel supply lines, air ducts, pumps, and other components. They then connect electrical wiring and controls, and check the unit for proper operation.

Oil burner mechanics (D.O.T. 862.281) keep oil-fueled heating systems in good operating condition. During the fall and winter, when the system is needed most, they service and adjust oil burners. If a burner is not operating properly, mechanics check the thermostat, burner nozzles, controls, and other parts to locate the problem. Mechanics carry replacement parts in their trucks to make repairs in the customer's home or place of business. However, if major repairs are necessary, they usually complete the repairs in the shop. During the summer when most systems are off, mechanics service heating units, replace oil and air filters, and vacuum-clean vents, ducts, and other parts of the heating system that accumulate soot and ash.

Gas burner mechanics (D.O.T. 637.281), also called gas appliance servicers, have duties similar to those of oil burner mechanics. They diagnose malfunctions in gas-fueled heating systems and make necessary repairs and adjustments. They also repair cooking stoves, clothes dryers, and hot water heaters. During the summer, mechanics employed by gas utility companies may inspect and repair gas meters.

Air-conditioning, refrigeration, and heating mechanics use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, and acetylene torches. They also use voltmeters, electronic circuit testers, and other testing devices.

Cooling and heating systems sometimes are installed or repaired by other craft workers. For example, on a large air-conditioning installation



Air-conditioning mechanic uses voltmeter to locate equipment breakdown.

job, especially where workers are covered by union contracts, duct work might be done by sheet-metal workers; electrical work by electricians; and installation of piping, condensers, and other components by pipefitters. Appliance servicers often install and repair window air-conditioners. Additional information about these occupations appears elsewhere in the *Handbook*.

Places of Employment

Approximately 175,000 persons worked as air-conditioning, refrigeration, and heating mechanics in 1976. Cooling and heating dealers and contractors employed most air-conditioning and refrigeration mechanics and furnace installers. Fuel oil dealers employed most oil burner mechanics, and gas utility companies, most gas burner mechanics. Approximately 1 out of 7 mechanics was self-employed.

Air-conditioning and refrigeration mechanics and furnace installers work in all parts of the country. Generally, the geographic distribution of these workers is similar to that of our population. Oil burner mechanics are concentrated in States where oil is a major heating fuel. More than half work in Massachusetts, New Jersey, New York, Pennsylvania, Illinois, and Michigan. Similarly, gas burner mechanics are concentrated in States where gas is a major heating fuel. Almost half worked in Texas, California, Ohio, Michigan, and Illinois.

Training, Other Qualifications, and Advancement

Most air-conditioning, refrigeration, and heating mechanics start as helpers and acquire their skills by working for several years with experienced mechanics. The remainder learn through apprenticeship.

All new workers in these trades receive similar on-the-job training, lasting 4 to 5 years. They begin by doing simple tasks such as carrying materials, insulating refrigerant lines, or cleaning furnaces. Within a year, they learn to cut, braze, and solder pipe and tubing; within three, to install fittings and work with sheet metal. By the end of training, they are capable of checking circuits and installing burners and pumps.

In addition to on-the-job training, apprentices must have related classroom instruction in subjects such as math, blueprint reading, and basic construction and engineering concepts.

When hiring helpers or apprentices, employers prefer high school graduates with mechanical aptitude who have had courses in mathematics, physics, electronics, and blueprint reading. Good physical condition also is necessary because workers sometimes have to lift and move heavy equipment.

Many high schools and vocational schools offer basic mechanic courses, some of which are taught by members of local firms and organizations such as the Air-conditioning and Refrigeration Institute and the Petroleum Marketing Education Foundation. These courses may last from 2 to 3 years.

Employment Outlook

Employment of air-conditioning, refrigeration, and heating mechanics is expected to increase much faster than the average for all occupations through the mid-1980's. In addition to the job openings from employment growth, many openings will occur as experienced mechanics transfer to other fields of work, retire, or die.

Most openings will be for air-conditioning and refrigeration mechanics. An increase in household formation and rising personal incomes should result in a very rapid increase in the number of air-conditioned homes. Air-conditioning in schools, factories, and other buildings also is expected to increase. In addition, more refrigeration equipment will be needed in the production, storage, and marketing of food and other perishables.

Employment of furnace installers and gas burner mechanics is expected to follow the growth trends in the construction of homes and businesses. Employment of oil burner mechanics should also grow as customers have their heating systems serviced more frequently in order to conserve oil.

Earnings and Working Conditions

Depending on the area of the country and the experience of the worker, hourly rates for skilled air-conditioning, refrigeration, and heating mechanics ranged from about $6 to $10 in 1976, according to limited information. In comparison, the average hourly rate for production and nonsupervisory workers in private industry, except farming, was $4.87. Mechanics who worked on both air-conditioning and heating equipment frequently had higher rates of pay than those who worked on only one type of equipment. Starting rates for helpers and apprentices are about 55 to 65 percent of those paid to experienced workers; with experience, rates increase.

Most mechanics work a 40-hour week. However, during seasonal peaks they often work overtime or irregular hours. Air-conditioning and refrigeration mechanics are busiest during spring and summer, and heating mechanics are busiest during fall and winter. Most employers try to provide a full workweek the year round, but they may temporarily reduce hours or lay off some mechanics when seasonal peaks end. However, employment in most shops that service both air-conditioning and heating equipment is fairly stable throughout the year.

Mechanics sometimes are required to work at great heights when installing new equipment. They also may work in awkward or cramped positions. Hazards in this trade include electrical shock, torch burns, and muscle strains and other injuries from handling heavy equipment.

Sources of Additional Information

For more information about employment and training opportunities, contact the local office of the State employment service or firms that employ air-conditioning, refrigeration, and heating mechanics.

For pamphlets on career opportunities and training, write to:

Air-Conditioning and Refrigeration Institute, 1815 N. Fort Myer Dr., Arlington, Va. 22209. (The Institute prefers not to receive individual requests for large quantities of pamphlets.)

For information about training in oil heating systems, write to:

Petroleum Marketing Education Foundation, P. O. Box 11187, Columbia, S.C. 29211.

For career information about gas burner mechanics, write to:

American Gas Association, Inc., 1515 Wilson Blvd., Arlington, Va. 22209.

APPLIANCE REPAIRERS

(D.O.T. 637.281, 723.381, 723.844, and 827.281)

Nature of the Work

In the past, most household chores such as cooking and cleaning were performed by hand and often involved a great deal of time and physical effort. Today, a variety of labor-saving appliances make many household jobs much simpler to do. Microwave ovens cook in minutes meals that once took hours to prepare. Washers and dryers clean clothes with little physical effort. Indeed the number of household jobs machines can do is almost limitless. Even simple tasks such as cooking a hamburger or opening a can are done with appliances made specifically for those purposes. Servicing these machines is the job of the appliance repairer.

Appliance repairers usually specialize in servicing either portable appliances such as toasters and irons or major appliances such as refrigerators and ranges. In large repair shops, they may specialize in particular items such as clothes washers and dryers or refrigerators and freezers. Repairers generally do not install major appliances. This job usually is done by technicians who work for retail stores.

Portable appliances and major appliances that are rebuilt for resale are worked on in shops. Major appliances usually are repaired in customers' homes by appliance repairers who carry their tools and a number of commonly used parts with them in a truck.

To determine why an appliance is not working properly, appliance repairers may operate it to detect unusual noises, overheating, or excess vibration. Repairers also look for common sources of trouble such as faulty electrical connections. They may disassemble the appliance to examine the mechanical and electrical parts. To check electric systems, repairers follow wiring diagrams and use testing devices, such as ammeters, voltmeters, and ohmmeters.

After locating the trouble, the repairer makes the necessary repairs or replacements. The repair procedure varies with the type of appliance and repair involved. To fix a portable appliance such as a toaster, the repairer may replace a defective heating element. To fix a major appliance such as a washer, the repairer may replace worn bearings, transmission belts, or gears. To remove old parts and install new ones, repairers use common handtools, including screwdrivers, soldering irons, files, and pliers, and special tools designed for particular appliances. Repairers operate the appliance after completing a repair to check their work.

Repairers may answer customers' questions and complaints about appliances and frequently advise customers about the care and use of the appliance. For example, they may show the owners the proper loading of automatic washing machines or how to arrange dishes in dishwashers.

Appliance repairer fixing electric range.

Appliance repairers may give customers estimates on the cost of repairs and collect the payment for the repairs. They also may keep records of parts used and hours worked on each job.

Places of Employment

About 144,000 people were employed as appliance repairers in 1976. Most repairers work in independent appliance stores and repair shops. Others worked for service centers operated by appliance manufacturers, department stores, wholesalers, and gas and electric utility companies.

Appliance repairers are employed in almost every community, but are concentrated in the more highly populated States and metropolitan areas.

Training, Other Qualifications, and Advancement

Most appliance repairers start as helpers and acquire their skills through on-the-job training. The form of training varies among companies and usually depends on the type of appliance repaired by the company. In some shops that fix portable appliances, helpers work on a single type of appliance, such as vacuum cleaners, until they master its repair. Trainees then move on to work on a different type of appliance; this process continues until they can repair a variety of appliances. In other shops, helpers progress from simple jobs, such as replacing a switch, to more difficult jobs such as rewiring an appliance.

In companies that repair major appliances, beginners usually learn by helping experienced repairers during house calls. In other cases, they learn basic skills by working in the shop rebuilding used parts such as washing machine transmissions.

Many helpers receive supplemental instruction through training seminars that are conducted periodically by appliance manufacturers. These seminars usually last 1 or 2 weeks and deal with the repair of one type of appliance such as ovens. Up to 3 years of on-the-job training may be needed to become skilled in all aspects of repairing some of the more complex appliances.

Some large companies such as department store chains have formal training programs, which include home study courses and shop classes, where trainees work with demonstration appliances and other training equipment.

Experienced repairers continue to attend training classes periodically, and study service manuals to become familiar with new appliances and the proper ways to repair them.

Formal training in appliance repair and related subjects is available from some vocational schools, technical schools, and community colleges. However, graduates of these schools must gain on-the-job experience to become fully qualified repairers.

Persons who want to become appliance repairers generally must have a high school diploma. High school or vocational school courses in electricity are very helpful, because most repairs involve work with electrical equipment. Mechanical aptitude is also desirable. Appliance repairers who work in customers' homes must be able to get along with people.

Appliance repairers who work in large shops or service centers may be promoted to supervisor, assistant service manager, or service manager. A few may advance to managerial positions such as regional service manager or parts manager for appliance manufacturers. Preference is given to those who show ability to get along with coworkers and customers. Experienced repairers who have sufficient funds may open their own appliance stores or repair shops.

Employment Outlook

Employment of appliance repairers is expected to grow about as fast as the average for all occupations through the mid-1980's. In addition to the jobs created by growth of this occupation, many openings will arise each year from the need to replace experienced repairers who retire, die, or transfer to other occupations.

The number of appliances in use is expected to increase very rapidly as a result of increases in population and income, and the introduction of new and improved appliances. Maintaining this large number of appliances will increase the need for qualified appliance repairers.

People who enter the occupation should have steady work because the appliance repair business is not very sensitive to changes in economic conditions.

Earnings and Working Conditions

Hourly earnings of appliance repairers ranged from $4 to $7 in 1976, based on the limited data available. The starting rate for inexperienced trainees was about $3 an hour. The wide variations in wages reflect differences in the repairers' skill and experience, geographic location, and the type of equipment serviced.

Repair shops generally are quiet, well-lighted, and adequately ventilated. Working conditions outside the shop vary considerably. For example, repairers sometimes work in narrow spaces and uncomfortable positions amidst dirt and dust. Those who repair appliances in homes may spend several hours a day driving, although the use of 2-way radios has decreased this time.

Appliance repair work generally is safe, although accidents are possible while handling electrical parts or lifting and moving large appliances. Inexperienced workers are shown how to use tools safely and how to avoid electric shock.

Appliance repairers usually work with little or no direct supervision. This feature of the job appeals to many people.

Many appliance repairers belong to the International Brotherhood of Electrical Workers.

Sources of Additional Information

For further information about jobs in the appliance service field, contact local appliance repair shops, appliance dealers and utility companies, or the local office of the State employment service.

Information about training programs or work opportunities also is available from:

Association of Home Appliance Manufacturers, 20 N. Wacker Dr., Chicago, Ill. 60606.

AUTOMOBILE BODY REPAIRERS

(D.O.T. 807.381)

Nature of the Work

Every day thousands of motor vehicles are damaged in traffic accidents. Although some are wrecked, most can be made to look and drive like new. Automobile body repairers are the workers who straighten bent frames, remove dents, and replace crumpled parts that are beyond repair. Usually, they can fix all types of vehicles, but most repairers work mainly on cars and small trucks. A few specialize in working on large trucks, buses, or tractor trailors.

When a damaged vehicle is brought into the shop, body repairers generally receive instructions from their supervisors, who have determined which parts are to be restored or replaced and how much time the job should take.

Automobile body repairers use special machines to align damaged frames and body sections. They chain or clamp the semi-portable alignment machine to the damaged metal and apply hydraulic pressure to straighten it.

Body repairers remove badly damaged sections of body panels with a pneumatic metalcutting gun or acetylene torch, and weld in new sections to replace them. Sometimes, dented sections can be repaired rather than replaced; the repairers push dents out with a hydraulic jack or hand prying bar, or knock them out with a handtool or pneumatic hammer. Small dents and creases can be smoothed out by holding a small anvil against one side of the damaged area while hammering the opposite side. Very small pits and dimples are removed with pick hammers and punches.

Body repairers usually work by themselves with only general directions from supervisors.

Some small dents cannot be worked out of the metal. Body repairers fix these dents by first filling them with plastic or solder. Then, when the filler hardens, they file or grind it to its original shape and sand it smooth for painting. In most shops, automobile painters do the painting. (These workers are discussed elsewhere in the *Handbook*.) Some smaller shops employ workers who do both body repairing and painting.

Body repair work has variety—each damaged vehicle presents a different problem. Therefore, in addition to having a broad knowledge of automobile construction and repair techniques, repairers must develop appropriate methods for each job. Most of these skilled people find their work challenging and take pride in being able to restore automobiles.

Body repairers usually work by themselves with only general directions from supervisors. In some shops, they may be assisted by helpers. In large shops, body repairers may specialize in one type of repair, such as straightening bent frames or repairing doors or fenders.

Places of Employment

About 174,000 persons worked as automobile body repairers in 1976. Most worked for shops that specialized in body repairs and painting, and for automobile and truck dealers. Other employers included organizations that maintain their own motor vehicles, such as trucking companies and buslines. Motor vehicle manufacturers employed a small number of these workers.

Automobile body repairers work in every section of the country, with jobs in this occupation distributed in about the same way as population.

Training, Other Qualifications, and Advancement

Most automobile body repairers learn the trade on the job. They usually start as helpers and pick up skills from experienced workers. Helpers begin by assisting body repairers in tasks such as removing damaged parts and installing repaired parts. They gradually learn to remove small dents and make other minor repairs, and progress to more difficult tasks such as straightening frames. Generally, 3 to 4 years of on-the-job training are needed to become skilled in all aspects of body repair. Most training authorities recommend a 3- or 4-year formal apprenticeship program as the best way to learn the trade, but relatively few

of these programs are available. Apprenticeship includes both on-the-job and classroom instruction. Apprentices spend most of their time learning on the job, but they also are expected to attend classes in related subjects such as mathematics, job safety procedures, and business management.

Persons who want to learn this trade should be in good physical condition and know how to use tools. Courses in automobile body repair offered by high schools, vocational schools, and private trade schools provide helpful experience, as do courses in automobile mechanics. Although completion of high school generally is not a requirement, many employers believe graduation indicates that the person has at least some of the qualities of a good worker, such as the ability to see a task through to its completion. The latter is especially important as employers spend a good deal of time and money on training.

Automobile body repairers must buy handtools, but employers usually furnish power tools. The usual pattern is for trainees to accumulate tools as they gain experience. Many workers have a few hundred dollars invested in tools.

An experienced automobile body repairer with supervisory ability may advance to shop supervisor. Many workers open their own body repair shops. In fact, about one of every eight automobile body repairers is self-employed.

Employment Outlook

Employment of automobile body repairers is expected to increase about as fast as the average for all occupations through the mid-1980's.

Employment is expected to increase as a result of the rising number of motor vehicles damaged in traffic. Accidents are expected to increase as the number of motor vehicles grows, even though improved highways, driver training courses, lower speed limits, and improved bumpers and safety features on new vehicles may slow the rate of increase.

In addition to the job openings from employment growth, many openings are expected each year from the need to replace experienced repairers who retire or die. Also job openings will occur as some workers transfer to other occupations.

Most persons who enter the occupation may expect steady work since the automobile repair business is not very sensitive to changes in economic conditions.

Earnings and Working Conditions

Body repairers employed by automobile dealers in 36 large cities had estimated average hourly earnings of $8.20 in 1976, about one and three-fourths times the average for all nonsupervisory workers in private industry, except farming. Skilled body repairers usually earn between two and three times as much as inexperienced helpers and trainees.

Many body repairers employed by automobile dealers and repair shops are paid a commission, usually about half of the labor cost charged to the customer. Under this method, earnings depend on the amount of work assigned to the repairer and how fast it is completed. Employers frequently guarantee their commissioned workers a minimum weekly salary. Helpers and trainees usually receive an hourly rate until they are skilled enough to work on commission. Body repairers who work for trucking companies, buslines, and other organizations that maintain their own vehicles usually receive an hourly wage. Most body repairers work 40 to 48 hours a week.

Automobile body shops are noisy because of the banging of hammers against metal and the whir of power tools. Most shops are well-ventilated, but often they are dusty and have the odor of paint. Body repairers often work in awkward or cramped positions, and much of their work is strenuous and dirty. Hazards include cuts from sharp metal edges, burns from torches and heated metal, and injuries from power tools.

Many automobile body repairers are members of unions, including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Most body repairers who are union members work for large automobile dealers, trucking companies, and buslines.

Sources of Additional Information

More details about work opportunities may be obtained from local employers, such as automobile body repair shops and automobile dealers; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may be a source of information about apprenticeship and other programs that provide training opportunities.

For general information about the work of automobile body repair workers, write to:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils Inc., 188 Industrial Dr., Suite 112, Elmhurst, Ill. 60126.

AUTOMOBILE MECHANICS

(D.O.T. 620.131 through .381, .782, and .885; 721.281 and 825.281)

Nature of the Work

Anyone whose car has broken down knows how important the automobile mechanic's job is. The ability to make a quick and accurate diagnosis is one of the mechanic's most valuable skills. It requires good reasoning ability as well as a thorough knowledge of automobiles. In fact, many mechanics consider diagnosing "hard to find" troubles one of their most challenging and satisfying duties.

When mechanical or electrical troubles occur, mechanics first get a description of the symptoms from the owner or, if they work in a dealership, the service advisor who wrote

the repair order. If the cause of the trouble is hard to find, the mechanic may test drive the car or use testing equipment, such as motor analyzers, spark plug testers, or compression gauges, to locate the problem. Once the cause of the problem is found, mechanics make adjustments or repairs. If a part cannot be fixed, they replace it.

Most automobile mechanics perform a variety of repairs; others specialize. For example, *automatic transmission specialists* work on gear trains, couplings, hydraulic pumps, and other parts of automatic transmissions. Because these are complex mechanisms, their repair requires considerable experience and training, including a knowledge of hydraulics. *Tune-up mechanics* adjust the ignition timing and valves, and adjust or replace spark plugs, distributor points, and other parts to ensure efficient engine performance. They often use scientific test equipment to locate malfunctions in fuel and ignition systems.

Automobile air-conditioning specialists install air-conditioners and service components such as compressors and condensers. *Front-end mechanics* align and balance wheels and repair steering mechanisms and suspension systems. They frequently use special alignment equipment and wheel-balancing machines. *Brake mechanics* adjust brakes, replace brake linings, repair hydraulic cylinders, and make other repairs on brake systems. Some mechanics specialize in both brake and front-end work.

Automobile-radiator mechanics clean radiators with caustic solutions, locate and solder leaks, and install new radiator cores. They also may repair heaters and air-conditioners, and solder leaks in gasoline tanks. *Automobile-glass mechanics* replace broken windshield and window glass and repair window operating mechanisms. They install preformed glass to replace curved windows, and they use window patterns and glass-cutting tools to cut replacement glass from flat sheets. In some cases they may repair minor damage, such as pits, rather than replace the window.

To prevent breakdowns, most car owners have their cars checked regularly and parts adjusted, repaired, or replaced before they go bad. This responsibility of the mechanic is vital to safe and trouble-free driving. When doing preventive maintenance, mechanics may follow a checklist to be sure they examine all important parts. The list may include distributor points, spark plugs, carburetor, wheel balance, and other potentially troublesome items.

Places of Employment

Over 700,000 persons worked as automobile mechanics in 1976. Most worked for automobile dealers, automobile repair shops, and gasoline service stations. Others were employed by Federal, State, and local governments, taxicab and automobile leasing companies, and other organizations that repair their own automobiles. Some mechanics also were employed by automobile manufacturers to make final adjustments and repairs at the end of the assembly line. A small number of mechanics worked for department stores that have automobile service facilities.

Most automobile mechanics work in shops that employ from one to five mechanics, but some of the largest shops employ more than 100. Generally, automobile dealer shops employ more mechanics than independent shops.

Automobile mechanics work in every section of the country. Geographically, employment is distributed about the same as population.

Training, Other Qualifications, and Advancement

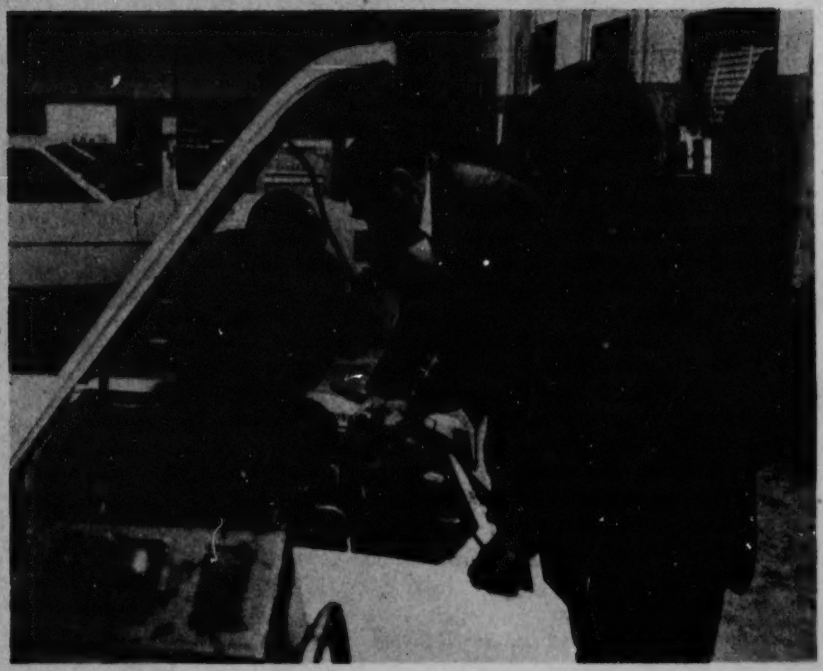
Most automobile mechanics learn the trade on the job. Beginners usually start as helpers, lubrication workers, or gasoline station attendants, and gradually acquire skills by working with experienced mechanics. Although a beginner can make simple repairs after a few months' experience, it usually takes 3 to 4 years to become familiar with all types of repairs. An additional year or two is necessary to learn a difficult specialty, such as automatic transmission repair. In contrast, radiator mechanics, glass mechanics, and brake specialists, who do not need an all-round knowledge of automobile repair, may learn their jobs in about 2 years.

Most training authorities recommend a 3- or 4-year formal apprenticeship program. These programs include both on-the-job training and classroom instruction. On-the-job training includes instruction in basic service procedures, such as engine tune-up, as well as instruction in special procedures such as overhauling transmissions. Classroom instruction includes courses in related theory such as mathematics and physics and other areas such as shop safety practices and customer relations.

For entry jobs, employers look for young persons with mechanical aptitude and a knowledge of automobiles. Generally, a driver's license is required as mechanics occasionally have to test drive or deliver cars. Working on cars in the Armed Forces or as a hobby is valuable experience. Completion of high school is an advantage in obtaining an entry job because to most employers it indicates that a young person has at least some of the traits of a good worker, such as perseverance and the ability to learn, and has potential for advancement. Courses in automobile repair offered by many high schools, vocational schools, and private trade schools also are helpful. In particular, courses in physical science and mathematics can help a person better understand how an automobile operates.

The usual practice is for mechanics to buy their handtools and beginners are expected to accumulate tools as they gain experience. Many experienced mechanics have several hundred dollars invested in tools. Employers furnish power tools, engine analyzers, and other test equipment.

Employers sometimes send experienced mechanics to factory training centers to learn to repair new models or to receive special training in subjects such as automatic transmission or air-conditioning repair. Manufacturers also send representatives to local shops to conduct short training sessions. Promising beginners may be selected by automobile dealers to at-



Most automobile mechanics learn the trade on the job.

tend factory-sponsored mechanic training programs.

Experienced mechanics who have leadership ability may advance to shop supervisor or service manager. Mechanics who like to work with customers may become service advisors. Many mechanics open their own repair shops or gasoline service stations and about 1 out of 7 automobile mechanics is self-employed.

Employment Outlook

Job opportunities for automobile mechanics will be plentiful in the years ahead. Because this is a large occupation, replacement needs are high. Thus, in addition to openings that will be created by employment growth, thousands of job openings will arise each year due to the need to replace experienced mechanics who retire, die, or change jobs.

Employment of automobile mechanics is expected to increase about as fast as the average for all occupations through the mid-1980's. The number of mechanics is expected to increase because expansion of the driving age population and consumer purchasing power will increase the number of automobiles on the road. Employment also is expected to grow because a greater number of automobiles will be equipped with pollution control and safety devices, air-conditioning, and other features that increase maintenance requirements.

Most persons who enter the occupation may expect steady work because the automobile repair business is not much affected by changes in economic conditions.

Earnings and Working Conditions

Skilled automobile mechanics employed by automobile dealers in 36 cities had estimated average hourly earnings of $7.76 in 1976, about two-thirds more than the average for all nonsupervisory workers in private industry, except farming.

Many experienced mechanics employed by automobile dealers and independent repair shops receive a commission, usually about half the labor cost charged to the customer. Under this method, weekly earnings depend on the amount of work completed by the mechanic. Employers frequently guarantee commissioned mechanics a minimum weekly salary. Skilled mechanics usually earn between two and three times as much as inexperienced helpers and trainees.

Most mechanics work between 40 and 48 hours a week, but many work even longer hours during busy periods. Mechanics paid by the hour frequently receive overtime rates for hours over 40 a week.

Generally, mechanics work indoors. Modern automobile repair shops are well ventilated, lighted, and heated, but older shops may not have these advantages.

Mechanics frequently work with dirty and greasy parts, and in awkward positions. Many of the automobile parts and tools that they must lift are heavy. Minor cuts and bruises are common, but serious accidents can be avoided by keeping the shop clean and orderly and observing other safety practices.

Some mechanics are members of labor unions. Among the unions organizing these workers are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

For more details about work opportunities, contact local employers such as automobile dealers and repair shops; locals of the unions previously mentioned; or the local office of the State employment service. The State employment service also may have information about apprenticeship and other programs that provide training opportunities.

For general information about the work of automobile mechanics, write to:

Automotive Service Industry Association, 230 North Michigan Ave., Chicago, Ill. 60601.

Automotive Service Councils, Inc., 188 Industrial Dr., Suite 112, Elmhurst, Ill. 60126.

National Automobile Dealers Association, 2000 K St. NW., Washington, D.C. 20006.

BOAT-ENGINE MECHANICS

(D.O.T. 623.281 and 625.281)

Nature of the Work

Boat engines have many things in common with automobile engines, including unannounced breakdowns. A reliable engine is particularly essential in boating. Breakdowns far from shore can leave a boater stranded for hours—a frustrating and potentially dangerous predicament if the weather turns bad.

To minimize the possibility of breakdowns, engine manufacturers recommend periodic inspections of engines by qualified mechanics to have engines examined and repaired and worn or defective parts replaced. Also, at periodic intervals the mechanic may replace ignition points, adjust valves, and clean the carburetor. After completing these tasks, the engine will be run to check for other needed adjustments. Routine maintenance jobs normally make up most of the mechanic's workload.

When breakdowns occur, mechanics diagnose the cause and repair faulty parts. A quick and accurate diagnosis—one of the mechanic's most valuable skills—requires problem-solving ability as well as a thorough knowledge of the engine's operation. Some jobs require only the replacement of a single item, such as a fuel pump, and may be completed in less than an hour. In contrast, tearing down and reassembling an engine to replace worn valves, bearings, or piston rings may take a day or more.

Mechanics may specialize in either outboard or inboard engines, although many repair both. Most small boats have portable gasoline-fueled outboard engines. Larger craft such as cabin cruisers and commercial fishing boats are powered by inboard engines (located inside the boat) and are similar to automobile engines. Some inboards burn diesel fuel rather than gasoline.

In large shops, mechanics usually work only on engines and other running gear. In small shops they also may patch and paint hulls and repair steering mechanisms, lights, and other boat equipment, such as refrigerators, two-way radios, and depth finders. In addition, they may repair enginecycles, mini-bikes, snowmobiles, lawnmowers, and other machines which have small gasoline engines that are similar to outboard engines.

Mechanic removes outboard engine to perform more extensive repairs.

Mechanics use common handtools such as screwdrivers and wrenches; power and machine tools, including drills and grinders; and hoists to lift engines and boats. Engine analyzers, compression gauges, and other testing devices help mechanics locate faulty parts. Mechanics refer to service manuals for assistance in assembling and repairing engines.

Places of Employment

Most of the 15,000 full-time boat-engine mechanics employed in 1976 worked in the shops of boat dealers and marinas. The next largest area of employment was in boat manufacturing plants where mechanics are employed to make final adjustments and repairs at the end of assembly lines. A small number of mechanics worked for boat rental firms. Marinas operated by Federal, State, and local governments also employed mechanics.

Dealer and marina shops typically employ one to three mechanics; few employ more than 10. Some small dealers and marinas do not employ mechanics; owners do the repair work or send it to larger shops.

Boat-engine mechanics work in every State, but employment is concentrated along coastal areas in Florida, Texas, New York, California, Louisiana, Washington, and New Jersey, and near the numerous lakes and rivers in Michigan, Minnesota, Wisconsin, Illinois, Ohio, Indiana, and Missouri. Mechanics who specialize in outboard engines work in all areas. Those who specialize in inboard engines generally work near oceans, bays, and large lakes.

Training, Other Qualifications, and Advancement

Boat-engine mechanics learn the trade on the job. At first, trainees clean boats and engines and do other odd jobs. Then, under the guidance of experienced mechanics, trainees learn to do other routine mechanical tasks such as replacing ignition points and spark plugs. As trainees gain experience, they progress to more difficult tasks such as diagnosing the cause of breakdowns and overhauling engines. Generally, an

inexperienced beginner needs 2 to 3 years on the job to become skilled in repairing both outboard and inboard gasoline engines. A capable mechanic can learn to repair diesels in an additional year or two.

Employers sometimes send trainees and mechanics to factory-sponsored courses for 1 to 2 weeks. Trainees learn the fundamentals of engine repair. Mechanics upgrade their skills and learn to repair new models.

In the past few years, several schools around the country have begun to offer formal training courses in marine engine repair and maintenance.

When hiring trainees, employers look for persons who have mechanical aptitude, are in good physical condition, and have an interest in boating. High school graduates are preferred, but many employers will hire people with less education. High school courses in small engine repair, automobile mechanics, machine shop, and science are helpful. Before graduating, a person may be able to get a summer job as a mechanic trainee.

Mechanics usually are required to furnish their own handtools. Beginners are expected to accumulate tools as they gain experience. Many experienced mechanics have several hundred dollars invested in tools. Employers provide power tools and test equipment.

Mechanics with leadership ability can advance to supervisory positions such as shop supervisor or service manager. Some boat-engine mechanics transfer to jobs as automobile mechanics. Others may become sales representatives. Mechanics who have the necessary capital may open their own dealerships or marinas.

Employment Outlook

Employment of boat-engine mechanics is expected to grow about as fast the average for all occupations through the mid-1980's. In addition to new positions, a few hundred openings will arise each year as experienced mechanics retire, die, or transfer to other occupations.

Employment is expected to increase due to the growth in the number of boats. The number of boats is expected to increase at about the same rate as the economy as a whole. As population grows, and people have more time for recreation, boating, like other leisure activities, will probably expand.

Employment opportunities will be particularly favorable for mechanics who have a knowledge of electricity and electronics. Electrical appliances are becoming more common on boats, and many new boats have two-way radios and depth finders.

Earnings and Working Conditions

According to a nationwide survey of boat dealers and marinas, estimated hourly earnings of experienced mechanics ranged from about $3.50 to $9.75 in 1976. Experienced mechanics generally earned two to three times as much as trainees.

Most mechanics are paid an hourly rate or weekly salary. Others are paid a percentage—usually 50 percent—of the labor charge for each repair job. If mechanics are paid on a percentage basis, their weekly earnings depend on the amount of work they are assigned and on the length of time they take to complete it.

Boating activity increases sharply as the weather grows warmer. Consequently, many mechanics work more than 40 hours a week in spring and summer. During the peak season, some mechanics may work 7 days a week. However, in the winter, they may work less than 40 hours a week; a relatively small number are laid off. In Northern States, some of the winter slack is taken up by repair work on snowmobiles.

The work is not hazardous, but mechanics sometimes suffer cuts, bruises, and other minor injuries. Shop working conditions vary from clean and spacious to dingy and cramped. All shops are noisy when engines are being tested. Mechanics occasionally must work in awkward positions to adjust or replace parts. For many mechanics, however, these disadvantages are more than compensated for by the variety of assignments and the satisfaction that comes from solving problems. Moreover, mechanics may enjoy working near water recreation areas.

Sources of Additional Information

For details about training or work opportunities, contact local boat dealers and marinas or local State employment offices.

BOWLING-PIN-MACHINE MECHANICS

(D.O.T. 829.281)

Nature of the Work

An important piece of machinery in the modern bowling center is the automatic pinsetter. It returns the ball to the bowler, clears the fallen pins from the alley, and resets pins for the next roll. When this complex machine fails to work properly, the game is held up and the bowling center may lose customers. Keeping pinsetters running properly is the job of bowling-pin-machine (or automatic pinsetter) mechanics.

When a pinsetter breaks or malfunctions, mechanics must quickly find the cause of the trouble and make repairs or adjustments so that bowlers will not be inconvenienced and annoyed. They refer to trouble-shooting manuals and diagrams of electrical circuits to guide their work. To fix the pinsetter, mechanics will repair, replace, or adjust broken mechanical or electrical parts such as gears, bearings, and motors.

Mechanics regularly service pinsetters to keep them operating properly. They inspect the machines for faulty parts and wiring, and also clean, lubricate, and adjust the gears, motors, and other moving parts.

Mechanics use many different types of tools, such as wrenches, screwdrivers, hammers, soldering irons, portable hoists, and lubricating guns, to repair and service the parts. They use ohmmeters, voltmeters, and other devices to test electrical circuits, relays, transformers, and motors.

Mechanics often supervise one or more assistant mechanics or pinchasers. Mechanics train these workers to locate and correct minor problems

Bowling-pin-machine mechanics spend much of their time inspecting and adjusting machines to prevent breakdowns.

such as pin-jams, by demonstrating how the machines operate and by disassembling the machine and explaining the function of the parts. Assistant mechanics or the pinchasers maintain the pinsetters when the mechanic is off duty.

In some bowling centers, mechanics perform other maintenance such as polishing lanes, reconditioning pins, and repairing seats and tables. Mechanics do some clerical work. They order replacement parts and keep an inventory of parts in stock. They also may keep records of pinsetter malfunctions and estimate maintenance costs.

Places of Employment

About 5,800 bowling-pin-machine mechanics were employed in 1976. Almost all worked in bowling centers. A small number were employed by manufacturers of automatic pinsetters to install the machines and service those in bowling centers that do not employ full-time mechanics.

Bowling-pin-machine mechanics are employed in every State, but employment is concentrated in heavily populated areas, where there are many bowling centers.

Training, Other Qualifications, and Advancement

Generally, there are no education or experience requirements for a job as a pinsetter mechanic. Some employers, however, prefer to hire applicants who are high school graduates and who have completed courses in electricity, blueprint reading, shop math, and machine repair.

Pinsetter mechanics usually begin work as assistant mechanics and are trained informally on the job. Trainees learn about the pinsetter's operation and maintenance by observing head mechanics and working on the machines under their supervision. Trainees are taught how to lubricate and clean pinsetters and to perform other preventive maintenance. Trainees also learn to diagnose and repair various kinds of machine breakdowns. Usually, 1 to 2 years of on-the-job training and experience are needed to acquire mechanics' skills.

A few mechanic trainees are sent to training courses conducted by pinsetter manufacturers. To take these training courses, a mechanic must work at a bowling center. The bowling center usually pays the tuition for the courses.

The courses, which last 2 to 4 weeks, include classroom lectures and shop work with demonstration machines. Trainees study the structure and operation of machines made by the firm operating the school, and learn to locate typical sources of trouble. They learn to perform preventive maintenance, to read wiring diagrams, and to use the tools of the trade. After attending factory schools, trainees usually need several months of on-the-job experience to qualify as mechanics.

People who want to become bowling-pin machine mechanics should have good eyesight (including normal color vision), good eye-hand coordination, and average physical strength. They also should have mechanical ability and like to work with their hands. Because speed often is required in repairing pinsetters, ability to work under pressure also is important.

Advancement opportunities for pinsetter mechanics are extremely

limited. Some mechanics become managers or owners of bowling establishments. Those who work for manufacturers may advance to service manager.

Employment Outlook

Employment of bowling-pin-machine mechanics is expected to grow more slowly than the average for all occupations through the mid-1980's. The demand for bowling facilities is likely to grow as the population increases. The growth in bowling facilities will be slower than in past years, however, so only a few new openings for pinsetter mechanics should occur. Most job openings will arise because of the need to replace experienced mechanics who retire, die, or leave the occupation for other reasons. However, because this occupation is very small, only a limited number of openings will become available.

Earnings and Working Conditions

Hourly earnings in 1976 ranged from $3 for mechanic trainees up to $5.50 for head mechanics, according to the limited information available.

Mechanics work in a long, relatively narrow corridor at the end of bowling lanes where the automatic pinsetters are located. The work area has space for a workbench and usually is well lighted and well ventilated, but quite noisy when the lanes are operating. When making repairs and adjustments, mechanics frequently have to climb and balance on the framework of the pinsetter, and to stoop, kneel, crouch, and crawl around the machines. Those who install and service machines for manufacturers must travel to the various bowling centers in their region.

The job generally is not dangerous but workers are subject to common shop hazards, such as electrical shock, cuts, falls, and bruises.

Some mechanics and trainees employed in large metropolitan areas are members of unions, usually the Service Employees International Union or the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.)

Sources of Additional Information

People who want further information about training or work opportunities in this trade should contact bowling centers in their area, the local bowling proprietors' association, or locals of the unions previously mentioned. The local office of the State employment service is another source of information about employment and training opportunities.

BUSINESS MACHINE REPAIRERS

(D.O.T. 633.281)

Nature of the Work

Business machine repairers maintain and repair the machines that are used to speed the paperwork in business and government. These include typewriters, adding and calculating machines, cash registers, dictating machines, postage meters, and duplicating and copying equipment. (Technicians who work on computer equipment are discussed in a separate statement elsewhere in the *Handbook*.)

Business machine repairers (often called field engineers or customer engineers) make regular vists for preventive maintenance to the offices and stores of customers in their assigned area. The frequency of these service calls depends upon the type of equipment being serviced. For example, an electric typewriter may require preventive maintenance only three or four times a year, while a more complex copier probably would require more frequent attention. During these calls, the engineer inspects the machine for unusual wear and replaces any worn or broken parts. Then the machine is cleaned, oiled, and adjusted to insure peak operating efficiency and to prevent future breakdowns. The engineer also may advise machine operators how to operate the equipment more efficiently and how to spot a problem in its early stages.

Despite frequent maintenance, business machines do occasionally malfunction. When a field engineer is notified by the supervisor of a breakdown, he or she will make a prompt service call to that customer. The engineer determines the cause of the malfunction by talking to the operator and examining the machine. Once the problem has been isolated, repairs can be made. Minor repairs generally can be made on the spot; for more serious repairs, however, the entire machine or a component of the machine will be taken to the repair shop where a specialist will work on it.

Business machine repairers generally specialize in one type of machine. Those employed by manufacturing companies or dealers usually are familiar only with the brand produced or sold by their employer. Repairers who work for small independent repair shops must be able to work on equipment from several different manufacturers.

Repairers use common handtools, such as screwdrivers, pliers, and wrenches, as well as other tools especially designed to fit certain kinds of business machines. In addition, they use meters and other types of test equipment to check for malfunctions in electronic circuits.

Places of Employment

About 58,000 people worked as business machine repairers in 1976. About three-fourths of them worked mainly on typewriters, calculators and adding machines, and copiers and duplicators. Most of the rest serviced accounting-bookkeeping machines, cash registers, and postage and mailing equipment. A small number repaired dictating machines.

About 8 of 10 repairers worked for business machine manufacturers, dealers, and repair shops. The remainder worked for large organizations that had enough machines to justify full-time repairers.

Business machine repairers work throughout the country. Even relatively small communities usually have at least one or two repair shops. Most repairers, however, work in large cities.

Business machine repair is cleaner and lighter than the work in most mechanical trades.

Training, Other Qualifications, and Advancement

The amount of formal education required for entry jobs as business machine repairers varies widely among employers. Some employers hire applicants with a high school education, while many others require at least 1 year of technical training in basic electricity or electronics. Employers agree, however, that electronics training received in the Armed Forces is valuable.

Applicants for entry jobs may have to pass tests that measure mechanical aptitude, knowledge of electricity or electronics, manual dexterity, and general intelligence. Good eyesight, including color vision, is needed to inspect and work on small, delicate parts. Persons considering this type of work also should have good hearing in order to detect malfunctions revealed by sound.

Employers seek applicants who have a pleasant, cooperative manner. Because most machine servicing is done in customers' offices, the ability to work without interrupting the office routine is very important. A neat appearance and ability to converse effectively are essential.

Some employers require that business machine repairers be bonded. Applicants for these jobs must be honest and trustworthy because they sometimes are exposed to large sums of money and other valuables in banks and offices. In addition, these workers must be able to work without direct supervision. They must be able to set up a maintenance schedule for their customers' equipment and arrange their own schedule so that they can meet service deadlines and also handle emergency repairs.

Trainees who work in a manufacturer's branch office or for a franchised dealer usually attend a school sponsored by the manufacturer. Training programs at company schools usually last several weeks to several months, depending on the type of machine the repairer will service. Trainees then receive from 1 to 3 years of practical experience and on-the-job training before they become fully qualified repairers. These workers generally learn to service only the company's line of equipment.

Training offered by independent repair shops usually is less formal. Trainees generally complete a self-study course coupled with on-the-job training under the supervision of an experienced repairer. Because small repair shops usually don't specialize in the more sophisticated types of equipment, their repairers are expected to be familiar with the more common machines produced by many manufacturers. For example, business machine repairers in small shops should be able to repair several different makes of typewriters, adding machines, and calculators.

Wherever they work, business machine repairers frequently attend training seminars sponsored by business equipment manufacturers for special instruction in new business machine developments. Also, business machine repairers are encouraged to broaden their technical knowledge during nonworking hours. Many companies pay the repairer's tuition for work-related courses in college and technical schools.

Business machine repairers may move into sales positions for greater earnings. Repairers who show management abilities also may advance to service manager or supervisor. Experienced repairers sometimes open their own repair shops; those who work in manufacturers' branch offices sometimes become independent dealers or buy sales franchises from the company.

Employment Outlook

Employment of business machine repairers is expected to grow faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will arise as experienced repairers retire, die, or change occupations.

Employment opportunities for qualified beginners are good. Busi-

ness and government will buy more machines to handle the growing volume of paperwork and more people will be trained to maintain and repair these machines. In recent years, many technical changes have occurred in business machines. Electronic calculating machines have replaced mechanical models, for example, and electronic cash registers are replacing mechanical registers. Because of the greater use of such equipment, opportunities will be particularly favorable for repairers who have training in electronics; within several years training in basic electronics may even become a prerequisite for business machine repair jobs.

Business machine repairers work year round and have steadier employment than many other skilled workers. Office machines must be maintained, even when business slackens, since records must be kept, correspondence carried on, and statistical reports prepared.

Earnings and Working Conditions

Information from a limited number of employers in 1976 indicated that trainees earned from $150 to $200 a week, depending on their level of training. For example, people who have previous electronics training in the Armed Forces or civilian technical schools generally receive somewhat higher beginning wages than high school graduates.

Experienced repairers generally earned from $200 to $280 a week. Earnings usually were highest for those who repaired electronic business machines and complex duplicating and copying equipment. Repairers who prepare themselves to work on more than one type of equipment can increase their earnings by about 20 percent. Specialists earned salaries ranging between $220 and $310 a week in 1976, according to the limited information available.

Servicing business machines is cleaner and less strenuous than the work in most other mechanical trades. Repairers generally wear business clothes and do most of their work in the customer's office. Injuries are uncommon.

Repairers generally use their own cars to travel to their customers' offices and are reimbursed on a mileage basis. Employers usually pay for all tools and other equipment.

Sources of Additional Information

For more details about job opportunities, contact local firms that sell and service business machines and the local office of the State employment service.

The State department of education in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

U.S. Office of Education, Division of Vocational/Technical Education, Washington, DC. 20202.

COMPUTER SERVICE TECHNICIANS

(D.O.T. 828.281)

Nature of the Work

Computer systems play a vital role in our lives. They help us make telephone calls, receive paychecks on time, and reserve tickets for travel, hotels, and entertainment. In business and industry, computer systems perform a wide variety of complicated tasks—from maintaining business records to controlling manufacturing processes.

A computer system is the combination of a computer and computer-related machines, such as magnetic tape readers and high speed printers. Keeping this intricate set of machines in good working order is the job of the computer service technician.

At regular intervals, computer service technicians (often called field engineers or customer engineers) service machines or systems to keep them operating efficiently. They routinely adjust, oil, and clean mechanical and electromechanical parts. They also check electronic equipment for loose connections and defective components or circuits.

When computer equipment breaks down technicians must find the cause of the failure and make repairs. Determining where in the system the malfunction has occurred is the most difficult part of the technician's job, and as computer systems have grown larger and more complex, the potential for malfunctions also has grown. The problem can be in the central processing unit itself, in one of the peripheral machines, such as a reader or a printer, or in the cables connecting these machines. Technicians use several kinds to test equipment, including voltmeters, ohmmeters, and oscilloscopes to check for electronic failures. They also run special diagnostic programs that help pinpoint certain malfunctions. Although it may take several hours to locate a problem, fixing the equipment may take just a few minutes. For repair jobs such as replacing a faulty circuit board, soldering a broken connection, or repairing a mechanical part, technicians use a variety of handtools, including needle-nosed pliers, wirestrippers, and soldering equipment. The employer supplies tools and test equipment, but technicians are responsible for keeping them in good working order.

Computer technicians often help install new equipment. They lay cables, hook up electrical connections between machines, thoroughly test the new equipment, and correct any problems before the customer uses the machine.

Some technicians specialize in maintaining a particular computer model or system, or in doing a certain type of repair. For example, some technicians are experts in correcting problems caused by errors in the computer's internal programming.

Besides knowing how to use specialized tools and test equipment, computer technicians must be familiar with technical and repair manuals for each piece of equipment. They also must keep up with the technical information and revised maintenance procedures issued periodically by computer manufacturers.

Technicians keep a record of preventive maintenance and repairs on each machine they service. In addition, they fill out time and expense

Some technicians specialize in maintaining a particular computer model or system.

reports, keep parts inventories, and order parts.

Although technicians spend most of their time working on machines, they work with people also. They listen to customers' complaints, answer questions, and sometimes offer technical advice on ways to keep equipment in good condition. Experienced technicians often help train new technicians and sometimes have limited supervisory duties.

Places of Employment

In 1976, about 50,000 persons worked as computer service technicians. Most were employed by firms that provide maintenance services for a fee and by manufacturers of computer equipment. A small number were employed directly by organizations that have a large computer installation.

Computer technicians generally work out of regional offices located in major urban centers, where computer equipment is concentrated. For example, about one-fourth of these workers are employed in one of these major cities: New York City; Philadelphia; Washington, D.C.; Chicago; and Los Angeles. Most are assigned to several clients, depending on the technician's specialty and the type of equipment the user has. Workers with several accounts must travel from place to place to maintain these systems and to make emergency repairs. In some cases, more than one technician will share an account, and service different parts of a system. In other cases, an experienced technician may be assigned to work full time at a client's installation in order to maintain all phases of that operation. Technicians who work for a nationwide organization must sometimes transfer to another city or State.

Training, Other Qualifications, and Advancement

Most employers require applicants for technician trainee jobs to have 1 to 2 years' post-high school training in basic electronics or electrical engineering. This training may be from a public or private vocational school, a college, or a junior college. Basic electronics training offered by the Armed Forces is excellent preparation for technician trainees.

A high school student interested in becoming a computer service technician should take courses in mathematics and physics. High school courses in electronics and computer programming also are helpful. Hobbies that involve electronics, such as operating ham or CB radios or building stereo equipment, also provide valuable experience.

Besides technical training, applicants for trainee jobs must have good close vision and normal color perception to work with small parts and color-coded wiring. Normal hearing is needed since some breakdowns are diagnosed by sound. Because technicians usually handle jobs alone, they must have the initiative to work without close supervision. Also important are a pleasant personality and neat appearance, since the work involves frequent contact with customers. Another important asset for the successful technician is patience, because some malfunctions occur infrequently and are very difficult to pinpoint. Applicants must pass a physical examination and, in some cases, get a security clearance.

Trainees usually attend company training centers for 3 to 6 months to learn elementary computer theory, computer math, and circuitry theory and to further their study of electronics. Classroom work is accompanied

by practical training in operating computer equipment, doing basic maintenance, and using test equipment to locate malfunctions.

In addition to formal instruction, trainees must complete 6 months to 2 years of on-the-job training. At first they work closely with experienced technicians, learning to maintain card readers, printers, and other machines that are relatively simple, but that have the basic mechanical and electronic features of a large computer system. As trainees gain experience they work on more complex equipment.

Because manufacturers continually redesign equipment and develop new uses for computers, experienced technicians frequently must attend training sessions to keep up with these changes and to broaden their technical skills. Many technicians take advanced training to specialize in a particular computer system or type of repair. Instruction also may include programming, systems analysis, and other subjects that improve the technician's general knowledge of the computer field.

Experienced technicians with advanced training may become specialists or "troubleshooters" who help technicians throughout their territory diagnose difficult problems. They also may work with engineers in designing equipment and developing maintenance procedures. Technicians with leadership ability may become supervisors or service managers.

Most computer equipment operates on the same basic principles, but machines built by different companies may be unique in design and construction. For this reason, technicians may find it difficult to transfer between companies that mantain different brands of equipment. Because of the pressing need for experienced technicians, however, many opportunities exist for well-qualified workers to transfer to other firms that handle the same type of computer hardware.

Training and experience in computer maintenance may also qualify a technician for a job in programming, management, or equipment sales. (See statements on Programmers and Office Machine and Computer Manufacturing elsewhere in the *Handbook*.)

Employment Outlook

Employment of computer technicians is expected to grow much faster than the average for all occupations through the mid-1980's. As the Nation's economy expands, more computer equipment will be used and more technicians will be needed to install and maintain it. Business, government, and other organizations will buy, lease, or rent additional equipment to manage vast amounts of information, control manufacturing processes, and aid in scientific research. The development of new uses for computers in fields such as education, medicine, and traffic control also will spur demand.

Because most technicians are young, relatively few openings will stem from deaths and retirements. Most job openings will result from rising demand for the services of computer service technicians. Most openings will occur in metropolitan areas.

The rising demand for computer technicians is related to the growing number of computers in operation and the geographic distribution of these computers. Continued reductions in the size and cost of computer hardware will bring the computer within reach of a rapidly increasing number of small organizations. As more and more of these small systems are installed, the amount of time technicians must spend traveling between clients also will increase.

Downturns in the economy will tend to have a less negative effect on job openings for computer service technicians than for most occupations because even when business is declining firms will continue to use computers for accounting and other data processing.

Earnings and Working Conditions

Average weekly earnings of computer service technician trainees ranged from about $180 to $200 a week in 1976, according to a private survey of firms engaged in computer maintenance. Experienced workers earned about $235 a week, while senior technicians, those with 8-10 years' experience, earned between $250 and $285. Highly skilled specialists averaged from $310 to $340 a week.

Because computer installations generally run around the clock, working time lost during a computer breakdown can be very expensive. For this reason, technicians must be available to make emergency repairs at any time, day or night. Although the normal workweek is 40 hours, overtime is standard. The method of assigning overtime varies by employer. Some technicians are on call 24 hours a day. Others work rotating shifts—days 1 week, nights the next. However it is implemented, computer technicians can expect substantial amounts of overtime; in many cases, annual overtime pay can be as much as 20 percent of base salary. For most technicians, travel is local and they usually are not away from home overnight. Employers pay for travel, including reimbursement for job-related uses of the technician's car, as well as work-related education expenses.

Although some bending and lifting is necessary, the computer technician's job is not strenuous. Work hazards are limited mainly to burns and electrical shock, and can be avoided if safety practices are followed.

Sources of Additional Information

For general information on careers in computer maintenance, contact the personnel department of computer manufacturers and computer maintenance firms in your area. The State department of education in your State capital can furnish information about approved technical institutes, junior colleges, and other institutions offering postsecondary training in basic electronics. Additional information about these schools is available from:

U.S. Office of Education, Division of Vocational/Technical Education, Washington, DC. 20202.

The State employment service office in your area may also be able to provide information about local job opportunities.

DIESEL MECHANICS

(D.O.T. 625.281)

Nature of the Work

Diesel engines are stronger and thus last longer than gasoline engines. In addition, they use fuel more efficiently than gasoline engines because the higher compression ratios found in diesel engines convert a higher percentage of the fuel into power. Because of their greater durability and efficiency, diesel engines are used to power most of the Nation's heavy vehicles and equipment.

Diesel mechanics repair and maintain diesel engines that power transportation equipment, such as heavy trucks, buses, boats, and locomotives; and construction equipment, such as bulldozers and cranes. They also service diesel farm tractors and a variety of other diesel-powered equipment, such as compressors and pumps used in oil well drilling and in irrigation.

Diesel mechanics repair and maintain a variety of diesel-powered equipment.

Before making repairs, diesel mechanics may use devices such as dynamometers to inspect and test engine components to determine why an engine is not operating properly. After locating the trouble, they repair or replace defective parts and make adjustments. Preventive maintenance—avoiding trouble before it starts—is another major responsibility. For example, they may periodically inspect, test, and adjust engine parts such as fan belts and fuel filters.

Many mechanics make all types of diesel engine repairs. Others specialize, in rebuilding engines, for example, or in repairing fuel injection systems, turbochargers, cylinder heads, or starting systems. Some also repair large natural gas engines used to power generators and other industrial equipment. In addition to maintaining and repairing engines, diesel mechanics may work on other parts of diesel-powered equipment, such as brakes and transmissions.

Most workers who maintain and repair diesel engines are not called diesel mechanics. Instead, their job titles usually indicate the type of diesel equipment they repair. For example, workers who maintain and repair diesel trucks or buses are called truck or bus mechanics and those who work on diesel farm tractors are called farm equipment mechanics. Many of these occupations are discussed elsewhere in the *Handbook*. (See statements on truck mechanics, bus mechanics, automobile mechanics, and farm equipment mechanics.)

Diesel mechanics use pliers, wrenches, screwdrivers, and other common handtools as well as special tools, such as valve refacers and piston pin-fitting machines. In addition, they may use complex testing equipment, such as a dynamometer to measure engine power, and special fuel injection testing equipment. Mechanics also may use machine tools to make replacement parts. They use powered hoists and other equipment for lifting and moving heavy parts.

Places of Employment

About 100,000 persons worked as diesel mechanics in 1976. Many worked for distributors and dealers that sell diesel engines, farm and construction equipment, and trucks. Others were employed by buslines, construction firms, and government agencies such as State highway departments. Some mechanics worked for diesel engine manufacturers and independent repair shops that specialize in diesels.

Because diesel engines are used throughout the country, diesel mechanics are employed in almost every town and city. However, those who work for trucking companies and buslines are employed mainly in large cities.

Training, Other Qualifications, and Advancement

Diesel mechanics learn their skills in several different ways. Many begin by repairing gasoline-powered automobiles, trucks, and buses. They usually start as helpers to experienced gasoline engine mechanics, becoming skilled in all types of repairs in 3 or 4 years. If the garage or business they work for uses or repairs diesel equipment, they receive several months of additional training in servicing this equipment. While learning to fix engines on the job, many find it helpful to take courses in diesel equipment maintenance offered by vocational, trade, and correspondence schools.

A few mechanics learn their trade through formal apprenticeship programs. These programs, which generally last 4 years, give trainees a combination of classroom training and practical experience. The classroom instruction usually covers blueprint reading, hydraulics, welding, and other subjects related to diesel repair.

Still another method of entry is through full-time attendance at trade or technical schools that offer training in diesel engine maintenance and repair. These programs generally last from several months to 2 years and provide classroom instruction and often practical experience. Graduates, however, usually need additional on-the-job training before they are capable of handling all types of diesel repair.

Experienced mechanics employed by companies that sell diesel-powered equipment sometimes are sent to special training classes conducted by engine manufacturers. In these classes, mechanics learn to maintain and repair the latest engines, using the most modern equipment. In addition, they may receive training in specialties such as engine rebuilding.

Employers prefer trainees and apprenticeship applicants who have a high school or vocational school education and mechanical ability. Shop courses in blueprint reading, automobile repair, and machine shop work are helpful, as are courses in science and mathematics. Because the work often requires lifting heavy parts, persons interested in becoming diesel mechanics should be in good physical condition.

Many diesel mechanics have to buy their own handtools and beginners are expected to accumulate tools as they gain experience. Experienced mechanics usually have several hundred dollars invested in their tools.

Mechanics who work for organizations that operate or repair large numbers of diesel engines, such as buslines or diesel equipment distributors, may advance to a supervisory position, such as shop supervisor or service manager.

Employment Outlook

Employment of diesel mechanics is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the jobs arising from employment growth, many openings will result from the need to replace experienced mechanics who transfer to other occupations, retire, or die.

Increased employment of mechanics is expected mainly because most industries that use diesel engines are expected to expand their activities in the years ahead. In addition, diesel engines will continue to replace gasoline engines in trucks, buses, and other equipment because properly tuned diesels use less fuel and produce less pollution.

Most new job openings in this field will be filled by mechanics who have experience in repairing gasoline engines. Companies that replace gasoline engine equipment with diesel-powered equipment usually retrain their experienced mechanics. Persons who have school training in diesel repair, but no practical experience, may be able to find jobs only as trainees.

Earnings and Working Conditions

According to a 1975-76 wage survey covering 36 metropolitan areas, mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles earned an average hourly wage of $6.67, more than one-third above the average for all nonsupervisory workers in private industry, except farming.

Diesel mechanics usually work 40 to 48 hours a week. Many work at night or on weekends, particularly if they work on buses, engines used in powerplants, or other diesel equipment used in serving the public. Some are subject to call for emergencies at any time. Mechanics generally receive a higher rate of pay when they work overtime, evenings, or weekends.

Most larger repair shops are pleasant places in which to work, but some small shops have poor lighting, heating, and ventilation. Diesel mechanics sometimes make repairs outdoors where breakdowns occur. If proper safety precautions are not taken, there is danger of injury when repairing heavy parts supported on jacks or hoists. In most jobs, mechanics handle greasy tools and engine parts. When making repairs, they sometimes must stand or lie in awkward positions.

Many diesel mechanics belong to labor unions, such as the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the Sheet Metal Workers' International Association; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

Information about work opportunities in this trade may be available from the local office of the State employment service. Other sources of information are firms that use or service diesel-powered equipment, such as truck and buslines, truck dealers, and construction and farm equipment dealers. Additional information on careers is available from:

International Association of Machinists and Aerospace Workers, 1300 Connecticut Ave. NW., Washington, D.C. 20036.

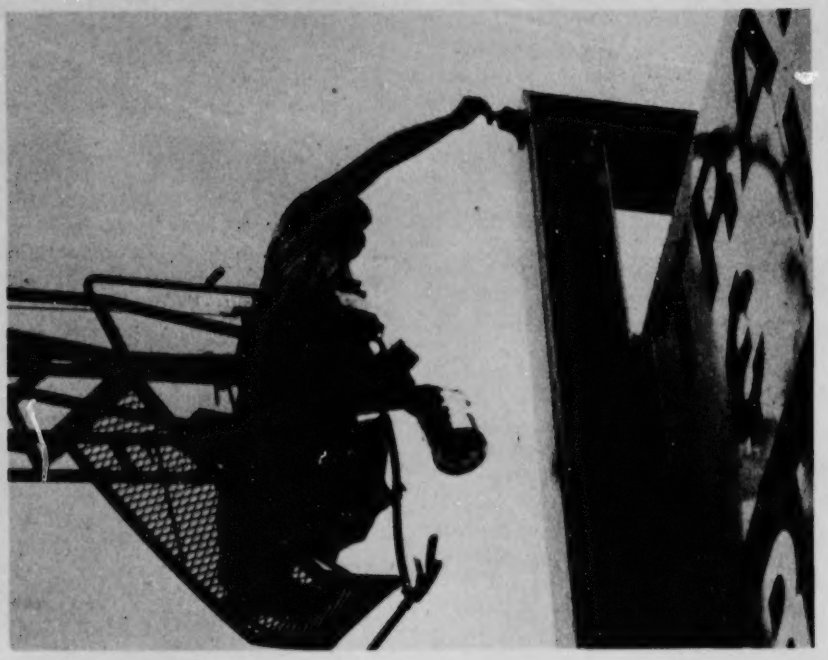
ELECTRIC SIGN REPAIRERS

(D.O.T. 824.281)

Nature of the Work

A common form of advertising for many businesses and products is the electric sign. Electric sign repairers maintain and repair neon and illuminated plastic signs so their owners can receive the most benefits from them.

When a sign requires service, repairers drive to its location, carrying their tools and a number of replacement parts in a truck. Repairers' trucks are equipped with ladders and boom cranes so they can work on tall



Repairers do most of their work at sign locations.

signs or those placed high above the ground. Common sources of sign trouble such as burned-out bulbs are easy to fix. However, in some cases, the problem may not be obvious and repairers may need to use electronic test equipment to determine the cause of a breakdown. Although simple repairs such as replacing bulbs or transformers are done at the site, major repairs of faulty parts such as neon tubing, are made in sign shops.

Repairers also do preventive maintenance and periodic inspection of signs to locate and correct defects before breakdowns occur. They check signs and remove debris such as birds' nests and accumulated water. Repairers also tighten or weld parts that have been loosened by winds and repaint beams, columns, and other framework. They may repaint portions of neon tubing to make the sign more readable. Motors, gears, bearings, and other parts of revolving signs may be checked, adjusted, and lubricated.

During periods with few service calls, repairers who work for sign manufacturing companies may help to assemble signs. Some repairers also install signs.

Repairers use common handtools and power tools, such as screwdrivers, pliers, saws, and electric drills. They also use ammeters, voltmeters, and other testing devices to locate malfunctioning electric parts. When replacing burned out parts such as a lamp or a flasher in illuminated plastic signs, repairers may refer to wiring diagrams and charts.

Repairers usually must fill out reports noting the date, place, and nature of service calls. They also may estimate the cost of service calls and sell maintenance contracts to sign owners.

Places of Employment

About 10,000 persons worked as electric sign repairers in 1976, primarily in small shops that manufacture, install, and service electric signs. Some worked for independent sign repair shops.

Electric sign repairers work throughout the country. However, employment is concentrated in large cities and in populous States, where large numbers of electric signs are used.

Training, Other Qualifications, and Advancement

Most electric sign repairers are hired as trainees and learn the trade informally on the job. Trainees perform the various phases of signmaking in the shop to obtain a general knowledge of tasks—such as cutting and assembling metal and plastic signs, mounting neon tubing, wiring signs, and installing electrical parts. After they have a thorough knowledge of the construction of signs, trainees accompany experienced repairers on service calls to learn to do repairs and maintenance. At least 4 years of on-the-job training and experience are required to become a fully qualified repairer.

Some people learn the trade through sign repairer or electrician apprenticeship programs that are conducted by some union locals and sign manufacturing shops. The apprenticeships usually last 4 years, emphasize on-the-job training, and include classroom instruction in subjects such as electrical theory and blueprint reading. Apprentices generally must be at least 18 years old with a high school diploma. Attempts are being made by unions and the National Electric Sign Association to increase the number of apprenticeship programs, so the availability of this type of training should increase in the future.

Employers prefer to hire high school or vocational school graduates, although many repairers have less education. Courses in mathematics, science, electronics, and blueprint reading are helpful to young people who are interested in learning this trade.

Repairers need good color vision because electric wires are frequently identified by color. They also need manual dexterity to handle tools, and physical strength to lift transformers and other heavy equipment. Because much of their work is done on ladders or from the baskets of boom trucks, repairers cannot be afraid of heights.

All electric sign repairers must be familiar with the National Electric Codes. Many cities require repairers to be licensed. Licenses can be obtained by passing an examination in

local electrical codes, and electrical theory and its application.

Highly skilled repairers may become supervisors. Because of their experience in servicing signs and dealing with customers, repairers sometimes become sign sales representatives. Repairers with sufficient funds can open their own sign manufacturing or repair shops.

Employment Outlook

Employment of electric sign repairers is expected to increase as fast as the average for all occupations through the mid-1980's. A rapid increase in the number of signs in use will spur demand for these workers. More signs will be needed as new businesses open and old ones expand and modernize their facilities. Signs already in use also will continue to require service because well maintained signs are good for business and also because many State and local governments require owners to keep their signs attractive. In addition to jobs from employment growth, some openings will arise as experienced workers retire, die, or leave the occupation for other reasons.

Earnings and Working Conditions

The earnings of electric sign repairers compare favorably with those of other skilled workers. It is estimated that the hourly wage rate of experienced repairers was about $7.80 in 1976, based on a survey of union wages and fringe benefits throughout the country. Apprentice rates usually range from $3.90 to $6.25 an hour.

Most electric sign repairers work an 8-hour day, 5 days a week, and receive premium pay for overtime. They also may receive extra pay for working at heights in excess of 30 feet.

Because most signs are out-of-doors, repairers are exposed to all kinds of weather. They sometimes make emergency repairs at night, on weekends, and on holidays. In some large cities, repairers patrol areas at night to locate and fix improperly operating signs. Hazards include electrical shock, burns, and falls from high places. Training programs emphasizing safety, and equipment, such as saskets on boom trucks, which allow easy access to signs, have reduced frequency of accidents. Repairers 4ay spend much time traveling to the site of a service call.

Many electric sign repairers belong to one the following unions: the International Brotherhood 6f Electrical Workers, the Sheet Metal Workers International Association, and the International Brotherhood of Painters and Allied Trades.

Sources of Additional Information

For further information on work opportunities, contact local sign manufacturing shops, the local office of the State employment service, or locals of the unions previously mentioned.

General information on job opportunities, wages, and the nature of the work is available from:

National Electric Sign Association, 2625 Butterfield Rd., Oak Brook, Ill. 60521.

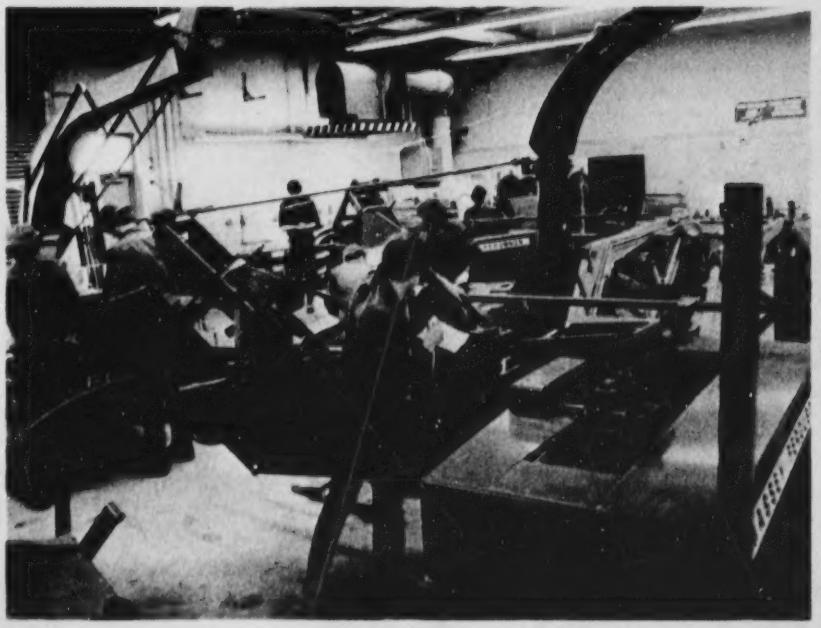
FARM EQUIPMENT MECHANICS

(D.O.T. 624.281 and .381)

Nature of the Work

Years ago farmers planted, cultivated, and harvested their crops using only handtools and simple animal-drawn equipment. Few repairs were required and if a stray rock or stump broke a plow blade, the metal pieces could be hammered back together by the local blacksmith. Even when tractors began to replace animals as the prime source of power, their simplicity made it possible for most farmers to do their own repair work.

But in the last quarter century farm equipment has grown enormously in size and variety. Many farms have both diesel and gasoline tractors, some equipped with 300-horsepower engines. Other machinery, such as harvesting combines, hay balers, corn pickers, crop dryers, and elevators, also is common. In today's world of mechanized agriculture, few if any types of farming can be done economically without specialized machines.



Farm equipment mechanics service most of the equipment used to plant, cultivate, and harvest food.

As farm machinery grew more complex, it became important for the sellers of farm equipment to be able to service and repair the machines they sold. Almost every dealer employs farm equipment mechanics to do this work and to maintain and repair the smaller lawn and garden tractors dealers sell to surburban homeowners.

In addition, some mechanics assemble new implements and machinery for farm equipment dealers and wholesalers, and occasionally they must repair dented or torn sheet metal on the bodies of tractors or other machinery.

Mechanics spend much of their time repairing and adjusting malfunctioning diesel- and gas-powered tractors that have been brought to the shop. During planting or harvesting seasons, however, the mechanic may travel to the farm to make emergency repairs so that crops can be harvested before they spoil.

Mechanics also perform preventive maintenance. Periodically, they test, adjust, and clean parts and tune engines. In large shops, mechanics may specialize in certain types of work, such as engine overhaul or clutch and transmission repair. Others specialize in repairing the air-conditioning units often included in the cabs of modern tractors and combines, or in repairing certain types of equipment such as hay balers. Some mechanics also repair plumbing, electrical, irrigation, and other equipment on farms.

Mechanics use many simple handtools including wrenches, pliers, hammers, and micrometers. They also may use more complex testing equipment, such as a dynamometer to measure engine performance, or a compression tester to find worn piston rings or leaking cylinder valves. They may use welding equipment or power tools to repair broken parts.

Places of Employment

Most of the estimated 66,000 farm equipment mechanics employed in 1976 worked in service departments of farm equipment dealers. Others worked in independent repair shops, in shops on large farms, and in service departments of farm equipment wholesalers and manufacturers. Most farm equipment repair shops employ fewer than five mechanics, although a few dealerships employ more than 10. A small proportion of farm equipment mechanics are self-employed.

Because some type of farming is done in nearly every area of the United States, farm equipment mechanics are employed throughout the country. As employment is concentrated in small cities and towns, this may be an attractive career choice for people who do not wish to live the fast-paced life of an urban environment. However, many mechanics work in the rural fringes of metropolitan areas, so farm equipment mechanics who prefer city life need not live in rural areas.

Training, Other Qualifications, and Advancement

Most farm equipment mechanics are hired as helpers and learn the trade on the job by assisting qualified mechanics. The length of training varies with the helper's aptitude and prior experience. At least 2 years of on-the-job training usually are necessary before a mechanic can do most types of repair work, and additional training and experience are required for highly specialized repair and overhaul jobs.

Many farm equipment mechanics enter this occupation from a related occupation. For instance, they may gain experience as farmers and farm laborers, or as heavy equipment mechanics, auto mechanics, or air-conditioning mechanics. People who enter from related occupations also start as helpers, but they may not require as long a period of on-the-job training.

More and more mechanics who enter the trade have had vocational training in rural high schools, in junior and technical colleges, or in the Armed Forces. With the development of more complex farm implements, technical training in electronics has become more important.

A few farm equipment mechanics learn the trade by completing an apprenticeship program, which lasts from 3 to 4 years and includes on-the-job as well as classroom training in all phases of farm equipment repair and maintenance. Applicants for these programs usually are chosen from shop helpers.

Some farm equipment mechanics and trainees receive refresher training in short-term programs conducted by farm equipment manufacturers. These programs usually last several days. A company service representative explains the design and function of equipment and teaches maintenance and repair on new models of farm equipment. In addition, some dealers may give employees time off to attend local vocational schools that teach special weeklong classes in subjects such as air-conditioning repair or hydraulics.

Employers prefer applicants who have an aptitude for mechanical work. A farm background is an advantage since growing up on a farm usually provides experience in basic farm equipment repairs. Employers also prefer high school graduates, but some will hire applicants who have less education. In general, employers stress previous experience or training in diesel and gasoline engines, the maintenance and repair of hydraulics, and welding—subjects that may be learned in many high schools and vocational schools. Some employers also may require mechanics to be skilled at blueprint reading, because mechanics may have to refer to diagrams of machinery when making complex repairs to electrical and other systems.

Persons considering careers in this field should have the manual dexterity needed to handle tools and equipment. Occasionally, strength is required to lift, move, or hold in place heavy parts. Difficult repair jobs may require problem-solving abilities, so experienced mechanics should be able to work independently with minimum supervision.

Farm equipment mechanics may advance to shop supervisor or manager of a farm equipment dealership. Some mechanics open their own repair shops. A few farm equipment mechanics earn 2-year associate degrees in agricultural mechanics and advance to service representatives for farm equipment manufacturers.

Employment Outlook

Employment of farm equipment mechanics is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to jobs from employment growth, several hundred job opportunities will arise each year as experienced mechanics retire, die, or transfer to other occupations. Opportunities will be best for applicants who have lived or worked on farms and know how to operate farm machinery and make minor repairs.

The development of more technically advanced farm equipment, some of which will require greater maintenance, will increase the demand for mechanics. For instance, many newer tractors have much larger engines, and feature advanced transmissions of up to 24 speeds. More complex electrical systems also are used to operate the great variety of gauges and warning devices now used to alert the operator to problems such as brake wear, low oil pressure in the transmission, or insufficient coolant in the radiator. Advances such as these and air-conditioned cabs, which have improved the comfort of the operator, have made it more difficult for farmers to do their own repairs. Thus farmers will have to rely more on skilled mechanics in the future.

In addition to the larger and more complex farm machinery, sales of smaller lawn and garden equipment have increased vastly over the past decade and are expected to continue to do so. Most of the large manufacturers of farm equipment now produce a line of these smaller tractors and sell them through their established dealerships. More mechanics will be needed to service this additional equipment.

Earnings and Working Conditions

Average hourly wages of farm equipment mechanics ranged from about $3.50 to $6.35 in 1976, based on the limited information available. However, a few mechanics earned over $15,000 in 1976 because employees are paid time and a half for overtime. Farm equipment mechanics usually work a 44-hour week, which includes 4 hours on Saturday. During planting and harvesting seasons, however, they often work 6 to 7 days a week, 10 to 12 hours daily. In winter months, they may work fewer than 40 hours a week, and some may be laid off.

Mechanics often travel many miles to repair equipment in the field, and are exposed to all kinds of weather. They come in contact with grease, gasoline, rust, and dirt, and there is danger of injury when they repair heavy parts supported on jacks or by hoists. Engine burns and cuts from sharp edges of machinery also are possible.

Very few farm equipment mechanics belong to labor unions, but those who do are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

Details about work opportunities may be obtained from local farm equipment dealers and local offices of the State employment service. For general information about the occupation, write to:

National Farm and Power Equipment Dealers Association, 10877 Watson Road, St. Louis, Mo. 63127.

INDUSTRIAL MACHINERY REPAIRERS

(D.O.T. 626. Through 631.)

Nature of the Work

When a machine breaks down in a plant or factory, not only is the machine idle, but raw materials and human resources are wasted. It is the industrial machinery repairer's job to prevent these costly breakdowns and to make repairs as quickly as possible.

Industrial machinery repairers—often called maintenance mechanics—spend much time doing preventive maintenance. This includes keeping machines well oiled and greased, and periodically cleaning parts. The repairer regularly inspects machinery and checks performance. Tools such as micrometers, calipers, and depth gauges are used to measure and align all parts. For example, on sewing machines in the apparel industry, treadles may need adjustment and gears and bearings may have to be aligned. By keeping complete and up-to-date records, mechanics can anticipate trouble and hopefully service machinery before the factory's production is interrupted.

When repairs become necessary, the maintenance mechanic must first locate the specific cause of the problem. This challenge requires knowledge reinforced by instinct. For example, after hearing a vibration from a machine, the mechanic must decide whether it is due to worn belts, weak motor bearings, or any number of other possibilities. Repairers often follow blueprints and engineering specifications in maintaining and fixing equipment.

After correctly diagnosing the problem, the maintenance mechanic disassembles, and then repairs or replaces the necessary parts. Hand and power tools usually are needed. The repairer may use a screwdriver and a wrench to take the door off an oven or a crane to lift a printing press off the ground. Electronic testing equipment often is included in the mechanic's tools. Repairers use catalogs to order replacements for broken or defective parts. When parts are not readily available, or when a machine must be quickly returned to production, repairers may sketch a part that can be fabricated by the plant's machine shop.

The repairer reassembles and tests each piece of equipment after it has been serviced, for once it is back in operation, the machine is expected to work as if it were new.

Many of the industrial machinery repairer's duties, especially preventive maintenance, also are performed by millwrights. (See statement on millwrights elsewhere in the *Handbook*.)

Places of Employment

Industrial machinery repairers work in almost every industry that uses large amounts of machinery.

Industrial machinery repairers need agility.

Many of the 320,000 repairers employed in 1976 worked in the following manufacturing industries: food products, primary metals, machinery, chemicals, fabricated metal products, transportation equipment, paper, and rubber.

Because industrial machinery repairers work in a wide variety of plants, they are employed in every section of the country. Employment is concentrated, however, in heavily industrialized areas.

Training, Other Qualifications, and Advancement

Most workers who become industrial machinery repairers start as helpers and pick up the skills of the trade informally, through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both on-the-job training and related classroom (or correspondence school) instruction in subjects such as shop mathematics, blueprint reading, welding, and safety. Upgrade examinations may be administered periodically to determine the repairer's ability to maintain more advanced machinery. Some repairers are promoted to machinists or tool and die makers. A few become master mechanics.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility also are necessary because repairers sometimes have to lift heavy objects or do considerable climbing to reach equipment located high above the floor.

High school courses in mechanical drawing, mathematics, and blueprint reading are recommended for those interested in entering this trade.

Employment Outlook

Employment of industrial machinery repairers is expected to increase much faster than the average for all occupations through the mid-1980's. In addition to jobs from employment growth, many openings will result from the need to replace experienced repairers who retire, die, or transfer to other occupations.

More repairers will be needed to take care of the growing amount of machinery used in manufacturing, coal mining, oil exploration, and other industries. In addition, as machinery becomes more complex, repair work and preventive maintenance will become more essential.

Earnings and Working Conditions

According to a survey of metropolitan areas, hourly wages for industrial machinery repairers averaged $6.47 in 1976—one-third higher than the average for all nonsupervisory workers in private industry, except farming. Average hourly earnings of industrial machinery repairers in 12 areas that represent various regions of the country are shown in the following tabulation:

Area	*Hourly rate*
Detroit	$7.66
Indianapolis	7.18
Baltimore	7.13
Chicago	6.89
Houston	6.80
New York	6.33
Cincinnati	6.27
Minneapolis—St. Paul	6.24
St. Louis	6.19
New Orleans	5.71
Worcester, Mass.	5.59
Greenville—Spartanburg, S.C.	4.76

Industrial machinery repairers usually are not affected by seasonal changes in production. During slack periods when some plantworkers are laid off, repairers often are retained to do major overhaul jobs.

Industrial machinery repairers may be called to the plant during off-duty hours, especially in emergencies. Thus they may have to work nights and weekends, depending on the maintenance necessary.

Repairers may work in stooped or cramped positions, to reach the underside of a generator, for example. They also may find it necessary to work from the top of ladders when repairing a large machine. These workers are subject to common shop injuries such as cuts and bruises. Goggles, metal-tip shoes, safety helmets, and other protective devices help prevent injuries.

Labor unions to which most industrial machinery repairers belong include the United Steelworkers of America; the International Union, United Automobile, Aerospace and

Agricultural Implement Workers of America; the International Association of Machinists and Aerospace Workers; and the International Union of Electrical, Radio and Machine Workers.

Sources of Additional Information

Information about employment and apprenticeship opportunities in this field may be available from local offices of the State employment service or the following organizations:

International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical, Radio, and Machine Workers, 1126-16th St. NW., Washington, D.C. 20036.

INSTRUMENT REPAIRERS

(D.O.T. 710.131, 710.281, 729.281, 823.281, and 828.281)

Nature of the Work

Nearly all areas of industry and research depend on measuring devices called instruments. For example, steel plants use hundreds of instruments to analyze, record and control their production processes. Airline pilots depend on instruments to navigate between airports and to make safe landings. Doctors use electrocardiographs and other medical instruments to diagnose and treat disease. Indeed, the variety and applications of instruments are almost limitless. Repairing, servicing, and installing this equipment is the job of the instrument repairer, often called instrument technician.

Technicians usually specialize in the repair of instruments used by a particular industry such as process control instruments or aircraft navigation instruments. Because the instruments are different, the duties of repairers vary by industry, although much of the work is similar.

When an instrument is not working correctly, repairers attempt to determine the cause and correct the problem at the site. Often the repairer can fix the instrument by making a simple adjustment with a handtool or a minor repair such as resoldering a loose connection. If the cause of the breakdown cannot be located easily or major repairs are required, the broken instrument may be taken to the repair shop. In the shop, the technician disassembles the faulty instrument and examines the individual parts or the electric circuitry. When the source of the breakdown is located, the technician makes repairs such as replacing worn or damaged parts. After reassembling the instrument, the repairer uses test equipment to adjust the instrument and to check its accuracy.

In some cases, an instrument malfunctions because it is used improperly. Repairers often must understand the entire production process to determine whether the instrument, other equipment, or the operator is at fault. In such situations, repairers may have to show the operator how to use and care for the instrument properly.

Repairers also perform preventive maintenance in the field or by taking the equipment to the shop for inspection on a regular basis. At the shop, worn or defective parts that might break down are replaced or repaired. Instruments also are cleaned, lubricated, adjusted, and tested, before being replaced.

Technicans may install new instruments. After installation, the instruments are tested for accuracy and adjusted to insure their proper operation.

Repairers use testing equipment such as pressure gauges and voltmeters and information from maintenance manuals, electrical diagrams, and blueprints to locate malfunctions. They use handtools such as screwdrivers and wrenches, and bench tools such as jewelers' lathes and pin vises to make repairs and adjustments. In some companies, they operate drill presses, polishers, and other machine tools to make new parts or to change standard parts to fit particular instruments. When an instrument must be set precisely, they may use jewelers' loupes, micrometers, or microscopes.

Place of Employment

About 75,000 persons worked as instrument repairers in 1976. Most of them worked for the manufacturing industries that use instruments in automated production and process control systems such as petroleum and chemical firms, gas and electric utilities, and producers of paper, food products, steel, aluminum, rubber, aircraft, and automobiles. Large numbers of technicians were employed by instrument manufacturers to install and service their customers' equipment. Others worked for firms that offer installation and repair services to instrument users. A few thousand, primarily aircraft instrument repairers, worked for Federal agencies, mainly the Air Force, Navy, and Army.

Training, Other Qualifications, and Advancement

At least 4 years of on-the-job training and study usually are required in order to become an instrument repairer. However, training time depends upon individual ability, previous experience and training, and complexity of the instruments serviced.

Training for entry into the occupation is available from several sources. In plants using instruments, repairers generally are selected from production or maintenance employees or are hired as trainees. Training programs may be conducted informally on the job or through formal apprenticeships, which usually are established by union contract. Both types of training emphasize work experience with the instruments in the plant and often include courses in instrumentation theory, mathematics, blueprint reading, physics, electronics, and chemistry. These courses may be taken by correspondence or at technical schools and community colleges.

Some people train for instrument repair work in technical institutes and junior colleges that grant associate degrees in instrumentation. The curriculum in these schools usually includes courses in basic electricity, mathematics, applied sciences, and the operation and maintenance of

A good knowledge of electronics is helpful in instrument repair work.

particular instruments. Shop training with various instruments is emphasized. Programs offered by these schools usually last 2 years.

Armed Forces technical schools also offer excellent training in instrument servicing. Skills acquired in this way help a person qualify for a civilian job as an instrument repairer.

Several instrument manufacturers offer specialized training to experienced repairers employed by their customers. This training may last from 1 week to 9 months, depending upon the number and complexity of the instruments. Courses are given in theory, maintenance, and operation of the instruments produced by these manufacturers. Instrument repairers also keep up with new developments in their field by reading trade magazines and manufacturers' service manuals.

Trainees or apprentices generally must be high school graduates. Courses in algebra, trigonometry, physics, chemistry, electronics, machine shop, and blueprint reading are considered particularly useful and may be required for entry into junior colleges. Some employers give tests to applicants to determine their mechanical aptitude.

Good eye-hand coordination and finger dexterity are needed to handle delicate parts. The ability to work without close supervision also is important. Experience with electronic equipment such as building and maintaining a "ham" radio station is helpful for an individual planning to become an instrument repairer.

Instrument repairers may become supervisors in maintenance and repair departments. Some may advance to positions as service representatives for instrument manufacturers. If they obtain additional education, instrument repairers may become engineering assistants or engineers. Instruments are becoming more complex, and technical school training is becoming an essential requirement for instrument repair work. This kind of training will provide a better base for advancement.

Employment Outlook

Employment of instrument repairers is expected to increase as fast as the average for all occupations through the mid-1980's. In addition to job openings caused by employment growth, many openings will result annually from the need to replace experienced repairers who retire, die, or leave the occupation for other reasons.

Additional instrument repairers will be needed because the use of technically sophisticated instruments for measurement, analysis, and control in industry and scientific research is expected to increase. Industrial instruments for process control in a number of industries including steel, food, and rubber are expected to increase substantially. In addition, more instruments will be used in research laboratories, aircraft and missiles, and automotive repair shops.

Opportunities for instrument repairers are expected to be particularly favorable in the petroleum, chemicals, and medical supplies industries, arising from increased emphasis on energy conservation and exploration, air and water pollution monitoring, and medical diagnosis.

Earnings and Working Conditions

According to the limited information available, instrument repairers received between $5 and $10 an hour in 1976. Those specializing in the repair of electronic instruments and systems often receive higher wages. Instrument repairers employed by Federal agencies receive rates comparable to those in private industry.

Most instrument repairers work a 40-hour, 5-day week. Those employed in process plants that operate around the clock may work on any of three shifts or rotate among shifts. Repairers also may be called to work with emergency crews at nights or on Sundays and holidays.

Work settings for instrument repairers vary from factory floors amid noise, heat, and fumes to quiet, clean, well-lighted shops. In some industries, such as chemicals, petroleum, and steel, repairers may have to work outdoors. Those employed by companies that service or manufacture instruments may travel frequently.

Many instrument repairers belong to unions, including the International Association of Machinists and Aerospace Workers; International Brotherhood of Electrical Workers; United

Paperworkers International Union; International Chemical Workers Union; International Union of Electrical, Radio and Machine Workers; International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; Oil, Chemical and Atomic Workers International Union; United Steelworkers of America; Utility Workers Union of America; and United Association of Journeymen and Apprentices of the Plumbers and Pipefitters.

Sources of Additional Information

The local office of the State employment service may be a source of information about training and employment opportunities for persons who wish to enter this occupation. Additional information is available from:

Instrument Society of America, 400 Stanwix St., Pittsburgh, Pa. 15222.

Inquiries concerning positions with the Federal Government should be made at the regional offices of the U.S. Civil Service Commission.

JEWELERS

(D.O.T. 700.281 and .381)

Nature of the Work

For centuries people have adorned themselves with rings, necklaces, and other ornaments made from precious metals and stones. The creation and repair of such beautiful items is the work of a jeweler.

Generally jewelers specialize in a particular manufacturing operation such as designing, modelmaking, stone setting, or engraving. Some specialize in repair work such as enlarging and reducing rings, resetting stones, soldering broken parts, or redesigning old jewelry.

The method of producing jewelry varies with the item made and materials used. For special orders, jewelers follow either their own designs or those created by designers. They outline the design on metal such as gold or silver, and then cut, fit, and shape each part. After preparatory polishing, they solder parts together to form the finished piece. Designs are carved in the metal and diamonds or other precious stones are mounted.

Jewelers' work is very delicate.

Costume jewelry and some kinds of precious jewelry are mass produced by factory workers using assembly line methods. The metal usually is melted and cast in a mold or shaped with a die. Skilled jewelers are needed, however, to design and make the molds and the dies, cast the jewelry pieces, and perform finishing operations, such as polishing, engraving and stone setting.

In their work jewelers use files, saws, hammers, punches, soldering irons, and a variety of other small handtools. Because the work is very detailed, jewelers often use a magnifying glass or eye "loupe."

Some jewelers own jewelry stores or shops that make and repair jewelry. In addition to working on jewelry, these small business people hire employees, order and sell merchandise, and handle other managerial duties.

Places of Employment

About 19,000 people had jobs as jewelers in 1976, one-third of whom were self-employed and owned retail jewelry stores and repair shops. About one out of every eight jewelers worked in a jewelry store. The remainder were about evenly distributed between jewelry factories and repair shops.

Most jewelers employed in precious jewelry production worked in or near New York City. Although jewelry stores and repair shops are located throughout the country, most jobs in these establishments are in metropolitan areas.

Training, Other Qualifications, and Advancement

Jewelers' skills usually are learned through informal on-the-job training. However, a limited number of formal courses are offered by industrial associations and technical schools.

Work in jewelry factories offers the best opportunties for persons to acquire all-round skills. In the precious jewelry industry the Amalga-

mated Jewelry, Diamond and Watchcase Workers Union and the manufacturers have established apprenticeships for many of the skilled occupations. Individuals who work in jewelry factories have the best chance to get such apprenticeships. The apprentices learn their trade through on-the-job training. Depending on the particular skill, apprenticeship programs for jewelry makers usually take from 3 to 4 years. For example, 3 years are required to become a colored-stone setter and 4 years to qualify as a diamond setter. All new apprentices receive the same starting wage and get periodic raises up to the minimum for their job. To overcome labor shortages in the modelmaking, moldmaking, and toolmaking occupations, manufacturers sponsor some courses in Providence, R.I. and New York City. These courses are intended for employees of jewelry manufacturers, and the tuition often is paid by the manufacturer.

Some technical schools offer instruction for 6 months to 3 years in watch and jewelry repair, and jewelry design and construction. These schools are a good source of training for someone outside the jewelry industry.

A high school education is desirable for young people entering the trade. Courses in art, mechanical drawing, and chemistry are particularly useful.

The precise and delicate nature of jewelry work requires finger and hand dexterity, good eye-hand coordination, patience, and concentration. Artistic ability is a major asset, because jewelry is primarily a form of adornment.

In manufacturing, jewelers sometimes advance to supervisory jobs. Some jewelers open their own jewelry stores or repair shops.

A substantial financial investment and a great personal commitment are required to operate a jewelry store, because the field is highly competitive. Jewelers who plan to open their own stores should have experience in selling jewelry. Those who can repair watches have an advantage, because watch repair accounts for much of the business in small stores.

Employment Outlook

Employment of jewelers is expected to grow more slowly than the average for all occupations through the mid-1980's. Though the demand for jewelry will increase as population grows, and as rising incomes enable people to spend more on luxuries, improved production methods will enable jewelry factories to meet the increased demand without hiring additional employees. However, many job openings will occur each year as experienced workers retire, die, or transfer to other occupations. Because of a shortage of skilled jewelers, opportunities for people with training in jewelry construction, design, or repair should exist throughout the industry.

Earnings and Working Conditions

According to limited information available, earnings of experienced jewelers ranged from about $5 to $7 an hour in 1976. Those in business for themselves can earn more.

Most jewelers in stores and repair shops work 40 to 48 hours a week. Some in factories work 35 hours a week.

Skilled jewelers usually work in well-lighted and well-ventilated surroundings.

Sources of Additional Information

For information on job opportunities in jewelry manufacturing, contact:

The Jewelry Institute, 340 Howard Building, 155 Westminster St., Providence, R.I. 02903.

For information on job opportunities in jewelry stores, contact:

Retail Jewelers of America, 10 Rooney Circle West Orange, N.J. 07052.

For a list of technical schools offering training in jewelry design and construction, contact:

Jewelers Circular Keystone, Chilton Way, Radnor, Pa. 19089.

LOCKSMITHS

(D.O.T. 709.281)

Nature of the Work

Locksmithing is an ancient trade—so old, in fact, that archeologists have found evidence of key-operated wooden locks made for Egyptian royalty as early as 2000 B.C. For many centuries, the locksmith's talents were available to only the relatively few who could afford the locks of the day, which were sometimes elaborate, if none too foolproof. In 1861, the pin tumbler lock was invented and a mass-production method developed that made these locks nearly as common as doors themselves. The locksmith came into demand as never before.

Today's locksmiths spend much of their time helping people who have locked themselves out of their cars, homes, and businesses. If the key has been left inside the car or house, for example, they may simply pick the lock. If, on the other hand, the keys are lost, new ones must be made. To do this, locksmiths first will try to obtain identifying key code numbers so that they can cut duplicates of the original key. Code numbers for a car's keys, for example, may be obtained by consulting the dealer who sold the car, or by checking the owner's bill of sale. Keys also can be duplicated by impression. In this case, locksmiths place a blank key in the lock and, by following marks left on the blank, file notches in it until it works.

Combination locks offer a special challenge. Locksmiths sometimes open them by touch, that is, by rotating the dial and feeling the vibrations when the wheels come into place. If all else fails, a hole may be drilled through the lock to open it. Finally, locksmiths repair damaged locks by replacing tumblers, springs, and other parts.

An important part of the locksmith's job is to recommend security measures to customers. For example, they may advise a firm to rekey its locks periodically. To rekey, locksmiths change the locking mechanism to fit new key codes, thus mak-

Locksmith shops typically employ one to three locksmiths.

ing the old keys useless. Rekeying a master system is one of the most complicated and time-consuming jobs handled by a locksmith. In a master system, some keys must open all doors; others open various combinations (for example, all doors on one floor); still others are individual keys for each door.

Some locksmiths install and repair electronic burglar alarms and surveillance systems that signal police or firefighters when break-ins or fires occur. A basic knowledge of electricity and electronics is needed to install and repair these systems. Much of the work is done by specialists called protective-signal repairers, rather than by locksmiths.

Locksmiths use screwdrivers, pliers, tweezers, and electric drills in their work, as well as special tools such as lockpicks. They make original and duplicate keys on keycutting machines. To guide them in their work, they refer to manuals that describe the construction of various locks.

Places of Employment

Most of the estimated 10,000 locksmiths in 1976 worked for locksmith shops. Many operated their own businesses. Locksmith shops typically employ one to three locksmiths; few employ more than five. Some locksmiths worked in hardware and department stores that offered locksmith services to the public; others worked in government agencies and large industrial plants. A small number worked for safe and lock manufacturers.

Although most jobs will be found in big cities, locksmiths work in virtually every part of the country. Locksmithing in small towns, however, is usually a part-time job, often combined with other work, such as fixing lawnmowers, guns, and bicycles.

Training, Other Qualifications, and Advancement

The skills of this trade are learned primarily through on-the-job training under experienced locksmiths. First, beginners may learn to duplicate keys and make keys from codes. Later, they learn to open, repair, and install locks, and finally, to work on safes. Generally, a beginner needs about 4 years of on-the-job training to qualify as a locksmith. Additional training is needed to service electronic security systems.

Formal training also is available in a few public and private schools that offer 1- to 2-year programs in locksmithing. Students are taught the basics of locksmithing such as repairing and opening locks. At some schools, students may specialize in safe repair or alarm systems. Completion of a course, however, does not assure a job; interested persons should check with local employers to make sure the school's training is acceptable.

Employers look for people who have mechanical aptitude, good hand-eye coordination, and manual dexterity. A neat appearance and a friendly, tactful manner also are important, since the locksmith has frequent contact with the public. Employers usually will not hire applicants who have been convicted of crimes.

Although high school graduates are preferred, many employers will hire applicants with less education. High school courses in machine shop, mechanical drawing, electronics, and mathematics are helpful. Completion of a correspondence school course in locksmithing increases the chances of getting a trainee job.

Many States and cities have licensing requirements. To obtain a license, the applicant generally must be fingerprinted and pay a fee. Some cities require that an individual pass a written or pratical examination.

However, specific requirements vary from city to city. Information on licensing may be obtained from local governments.

To keep up with new developments in their field, locksmiths read monthly technical journals or attend training classes at the annual convention of Associated Locksmiths of America.

Locksmiths can advance to shop supervisors—positions found, however, only in the larger shops. Experienced locksmiths also can go into business for themselves with relatively little capital. Many do business from their homes.

Employment Outlook

Employment in this relatively small occupation is expected to grow faster than the average for all occupations through the mid-1980's. In addition to the need to fill new positions, a few hundred openings will arise each year as experienced locksmiths retire, die, or transfer to other occupations.

Employment of locksmiths is expected to increase as a result of population growth and a more security-conscious public. Also, many businesses feel that conventional locks and other security devices are not adequate and are having more complex equipment installed. Opportunities will be particularly favorable for locksmiths who know how to install and service electronic security systems. Use of such systems has expanded greatly in recent years, and still greater growth is expected in the future. Opportunities also will be favorable for locksmiths who are willing to work at night to handle emergencies.

Earnings and Working Conditions

Experienced locksmiths earned from about $4.60 to $7.50 an hour in early 1976, according to the limited information available; many self-employed locksmiths earned even more. Trainees usually started at about $2.50 an hour, with periodic raises during training.

Most locksmiths receive an hourly rate or weekly salary, although some work on a commission basis, receiving a percentage of the money they collect; their earnings depend on the amount of work available and how quickly they complete it.

Locksmiths generally work year round. Most work 40 to 48 hours a week; even longer hours are common among the self-employed. The locksmith may be called at night to handle emergencies, though in many shops the responsibility to be "on call" is rotated among the staff.

Locksmiths do considerable driving from job to job. At times, they must work outside in bad weather and occasionally work in awkward positions for long periods. However, locksmithing is cleaner work than that of most mechanical trades and is comparatively free from the danger of injury.

Sources of Additional Information

Details about training and work opportunities may be available from local locksmith shops and local offices of the State employment service. For a list of schools offering courses in locksmithing and general information about the occupation, contact:

Associated Locksmiths of America, Inc., 3003 Live Oak St., Dallas, Tex. 75204.

MAINTENANCE ELECTRICIANS

(D.O.T. 825.281 and 829.281)

Nature of the Work

Maintenance electricians keep lighting systems, transformers, generators, and other electrical equipment in good working order. They also may install new electrical equipment.

Duties vary greatly, depending on where the electrician is employed. Electricians who work in large factories may repair particular items such as motors and welding machines. Those in office buildings and small plants usually fix all kinds of electrical equipment. Regardless of location, electricians spend much of their time doing preventive maintenance—periodic inspection of equipment to locate and correct defects before breakdowns occur. When trouble occurs, they must find the cause and make repairs quickly to prevent costly production losses. In emergencies, they advise management whether continued operation of equipment would be hazardous.

Maintenance electricians make repairs by replacing items such as a fuse, switch, or wire. When replacing a wire, they first make sure the power is off. Workers then pull the old wire from the conduit (a pipe or tube) and pull the new wire through to replace the old. Once the new wire is connected, they test to make sure the circuit is complete and functioning properly.

Maintenance electricians sometimes work from blueprints, wiring diagrams, or other specifications. They use meters and other testing devices to locate faulty equipment. To make repairs they use pliers, screwdrivers, wirecutters, drills, and other tools.

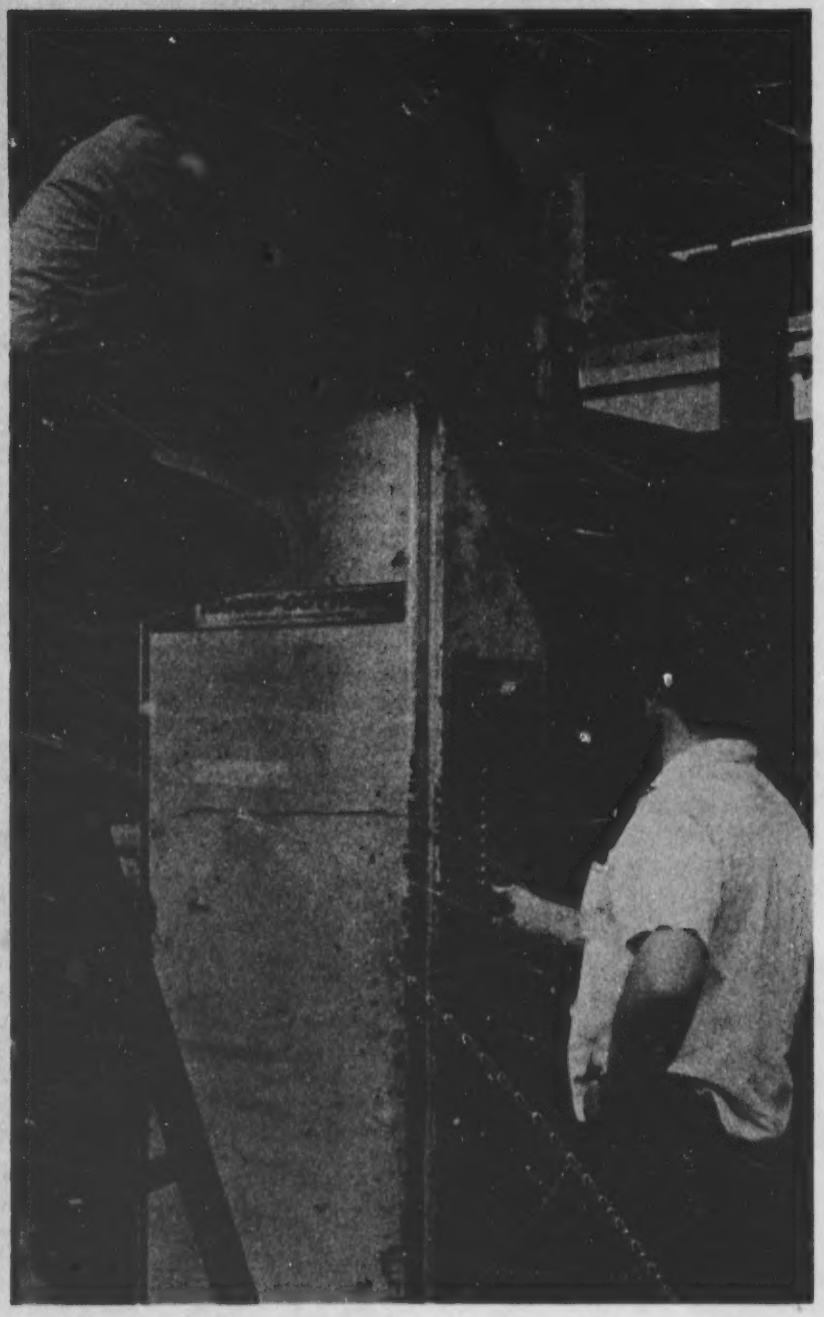
Places of Employment

An estimated 300,000 maintenance electricians were employed in 1976. More than half of them worked in manufacturing industries; large numbers worked in plants that make automobiles, machinery, chemicals, aluminum, and iron and steel. Many maintenance electricians also were employed by public utilities, mines, railroads, and by Federal, State, and local governments.

Maintenance electricians are employed in every State. Large numbers work in heavily industrialized States such as California, New York, Pennsylvania, Illinois, and Ohio.

Training, Other Qualifications, and Advancement

Most maintenance electricians learn their trade on the job or through formal apprenticeship programs. A relatively small number learn the trade in the Armed Forces. Training authorities generally agree that apprenticeship gives trainees more thorough knowledge of the trade and improved job opportunities during their working life. Because the training is comprehensive, people



More than half of all maintenance electricians work in manufacturing industries.

who complete apprenticeship programs may qualify either as maintenance or construction electricians.

Apprenticeship usually lasts 4 years, and consists of on-the-job training and related classroom instruction in subjects such as mathematics, electrical and electronic theory, and blueprint reading. Training may include motor repair, wire splicing, installation and repair of electronic controls and circuits, and welding and brazing.

Although apprenticeship is the preferred method of training, many people learn the trade informally on the job by serving as helpers to skilled maintenance electricians. Helpers begin by doing simple jobs such as replacing fuses or switches and, with experience, advance to more complicated jobs such as splicing and connecting wires. They eventually get enough experience to qualify as electricians. This method of learning the trade, however, may take more than 4 years.

Persons interested in becoming maintenance electricians can obtain a good background by taking high school or vocational school courses in electricity, electronics, algebra, mechanical drawing, shop, and science. To qualify for an apprenticeship program, an applicant must be at least 18 years old and usually must be a high school or vocational school graduate with 1 year of algebra.

Although physical strength is not essential, manual dexterity, agility, and good health are important. Good color vision is necessary because electrical wires frequently are identified by color.

All maintenance electricians should be familiar with the National Electric Code and local building codes. Many cities and counties require maintenance electricians to be licensed. Electricians can get a license by passing an examination that tests their knowledge of electrical theory and its application.

Some maintenance electricians become supervisors. Occasionally, they advance to jobs such as plant electrical superintendent or plant maintenance superintendent.

Employment Outlook

Employment of maintenance electricians is expected to increase about as fast as the average for all occupations through the mid-1980's. This growth will stem from increased use of electrical and electronic equipment by industry. In addition to the jobs from employment growth, a few thousand openings will arise each year to replace experienced electricians who retire, die, or transfer to other occupations.

Growth in the number of job openings is expected to be fairly steady in the years ahead since the demand for maintenance electricians is not very

sensitive to ups and downs in the economy. At times when construction activity is depressed, however, beginners may face competition for job openings because some unemployed construction electricians apply for these openings.

Earnings and Working Conditions

Earnings of maintenance electricians compare favorably with those of other skilled workers. In 1976, based on a survey of metropolitan areas, maintenance electricians averaged about $6.95 an hour, ranging from $4.84 in Greenville, S.C., to $8.02 in Indianapolis. By comparison, all production and nonsupervisory workers in private industry, except farming, averaged $4.87.

Apprentices start at about 60 percent of the skilled electrician's hourly pay rate and receive increases every 6 months.

During a single day, an electrician may repair equipment both in a clean, air-conditioned office and on a factory floor, surrounded by the noise, oil, and grease of machinery. Electricians often climb ladders or work on scaffolds in awkward or cramped positions.

Because maintenance electricians work near high-voltage industrial equipment, they must be alert and accurate. Errors in wiring installations could endanger both the electrician and other employees. Safety principles, which are a part of all electrician training programs, have reduced the frequency of accidents. Electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to fight small electrical fires.

Among unions organizing maintenance electricians are the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America (Ind.); and the United Steelworkers of America.

Sources of Additonal Information

Information about apprenticeships or other work opportunities in the trade is available from local firms that employ maintenance electricians, and from local union-management apprenticeship committees. In addition, the local office of the State employment service may provide information about training opportunities. Some State employment service offices screen applicants and give aptitude tests.

MOTORCYCLE MECHANICS

(D.O.T. 620.281 and .384)

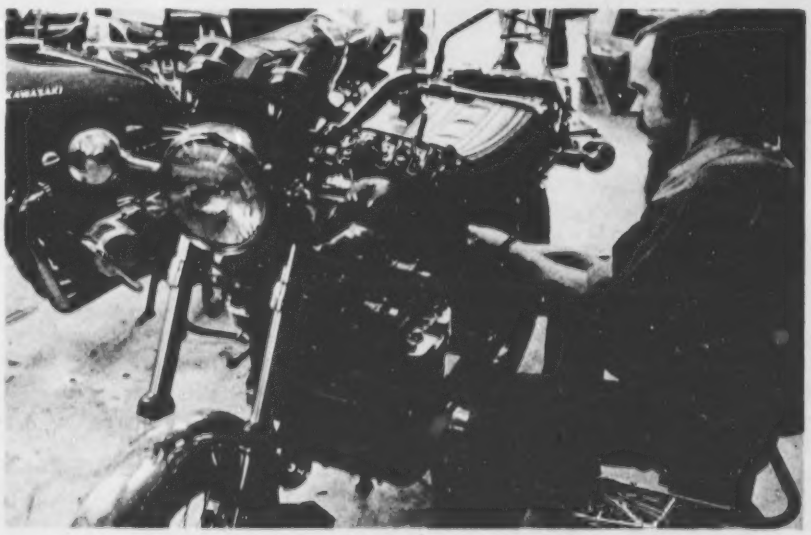
Nature of the Work

In 1950 there were just over 500,000 motorcycles in the United States. Today there are over 5 million. Accompanying this rapid rise in the number of motorcycles has been a rapid increase in the number of motorcycle mechanics. For although many cycling enthusiasts repair their own vehicles, most rely on skilled mechanics.

Motorcycles, like automobiles, need periodic servicing to operate at peak efficiency. Spark plugs, ignition points, brakes, and many other parts frequently require adjustment or replacement. This routine servicing represents the major part of the mechanic's work.

The mark of a skilled mechanic is the ability to diagnose mechanical and electrical problems and to make repairs in a minimum of time. In diagnosing problems, the mechanic first obtains a description of the symptoms from the owner, and then runs the engine or test-rides the motorcycle. The mechanic may have to use special testing equipment and disassemble some components for further examination. After pinpointing the problem, the mechanic makes needed adjustments or replacements. Some jobs require only the replacement of a single item, such as a carburetor or generator, and may be completed in less than an hour. In contrast, an overhaul may require several hours, because the mechanic must disassemble and reassemble the engine to replace worn valves, pistons, bearings, and other internal parts.

Mechanics use common handtools such as wrenches, pliers, and screwdrivers, as well as special tools for getting at parts that are hard to remove such as flywheels and bearings. They also use compression gauges, timing lights, and other kinds of testing devices. Hoists are used to lift heavy motorcycles.



Many motorcycle mechanics also repair minibikes and snowmobiles.

Most mechanics specialize in servicing only a few of the more than 30 brands of motorcycles and motor scooters. In large shops, some mechanics specialize in overhauling and rebuilding engines and transmissions, but most are expected to perform all kinds of repairs. Mechanics may occasionally repair mini-bikes, go-carts, snowmobiles, outboard motors, lawnmowers, and other equipment powered by small gasoline engines.

Places of Employment

About 12,000 persons had full-time jobs as motorcycle mechanics in 1976, and a few thousand more had part-time jobs. Most mechanics work for motorcycle dealers. Others work for city governments to maintain police motorcycles. A small number of mechanics work for firms that specialize in modifying or "customizing" motorcyles. Most shops employ fewer than five mechanics.

Motorcycle mechanics work in every State and major city. About half work in nine States: California, Michigan, Texas, Ohio, Pennsylvania, Illinois, Florida, Minnesota, and Indiana.

Mechanics who specialize in repairing motorcycles work mainly in metropolitan areas. In smaller cities, motorcycles frequently are repaired by owners or managers of motorcycle dealerships or by mechanics who repair all kinds of equipment powered by small gasoline engines, such as outboard motors and lawnmowers.

Training, Other Qualifications, and Advancement

Motorcycle mechanics usually learn their trade on the job, by picking up skills from experienced workers. Beginners usually start by learning to uncrate, assemble, and road-test new motorcycles. Next, they learn routine maintenance jobs such as adusting brakes and replacing spark plugs and ignition points. As trainees gain experience, they progress to more difficult tasks such as repairing electrical systems and overhauling engines and transmissions. Generally, 2 to 3 years of training on the job are necessary before trainees become skilled in all aspects of motorcycle repair.

Trainees usually accumulate handtools as they gain experience. Experienced mechanics often have several hundred dollars invested in tools.

Employers sometimes send mechanics and experienced trainees to special training courses conducted by motorcycle manufacturers and importers. These courses, which can last as long as 2 weeks, are designed to upgrade the worker's skills and provide information on repairing new models.

When hiring trainees, employers look particularly for cycling enthusiasts who have gained practical experience by repairing their own motorcycles. However, many employers will hire trainees with no riding experience if they have mechanical aptitude and show an interest in learning the work. Trainees must be able to obtain a motorcycle driver's license so they can deliver newly assembled motorcycles and test drive those brought in for repairs.

Most employers prefer high school graduates, but will accept applicants with less education. Courses in small engine repair—offered by some high schools and vocational schools—generally are helpful, as are courses in automobile mechanics, science, and mathematics. Many motorcycle dealers employ students to help assemble new motorcycles and perform minor repairs.

Public schools in some large cities offer postsecondary and adult education in small engine and motorcycle repair. Some technical schools have training programs for motorcycle mechanics. Many junior and community colleges offer courses in motorcycle repair.

Because all internal combustion engines are similar, skills learned through repairing motorcycles can be transferred to other fields of mechanical work. For example, motorcycle mechanics can become automobile, truck, or diesel mechanics after some additional training. However, transferring to one of these occupations would not necessarily mean higher earnings.

Motorcycle mechanics have limited advancement possibilities. Those with supervisory ability may advance to service manager and, eventually, to general manager in large dealerships. Those who have the necessary capital may become dealers.

Employment Outlook

Employment in this relatively small occupation is expected to grow faster than the average for all occupations through the mid-1980's. Openings arising from growth will fluctuate from year to year, however, as motorcycle sales and thus employment of motorcycle mechanics appear to be sensitive to dips in the business cycle. Additional openings will arise from the need to replace experienced mechanics who retire, die, or transfer to other fields of work.

Underlying the anticipated growth in the number of motorcyle mechanics is the continued growth in the number of motorcycles. Increases in the young adult population and in personal income levels will create a demand for more motorcycles, and additional mechanics will be needed to maintain these machines. Also, growth in the numbers of minibikes and snowmobiles will stimulate the demand for mechanics.

Opportunities for employment will be best in larger dealerships, most of which are located in the suburbs of metropolitan areas. Many motorcycle dealers in small cities do not have enough business to hire full-time trainees, but part-time or summer jobs may be available.

Earnings and Working Conditions

Earnings of motorcycle mechanics and trainees vary widely and depend on level of skill, geographic location, season of the year, and employer. Limited information indicates that experienced mechanics employed by motorcycle dealers earned between $4 and $10 an hour in late 1976. Generally, experienced mechanics earned 2 to 3 times as much as trainees.

Some mechanics receive an hourly rate or a weekly salary. Others receive a percentage—usually about 50 percent—of the labor cost charged to the customer. If a mechanic is paid

on a percentage basis, income depends on the amount of work assigned and how rapidly the mechanic completes it. Frequently, trainees are paid on a piecework basis when uncrating and assembling new motorcycles. At other times, they are paid an hourly rate or weekly salary.

Motorcycling increases sharply as the weather grows warmer. As a result, most mechanics work more than 40 hours a week during the summer. Many temporary workers hired to help handle the increased work load work only part time, and are laid off in the fall. However, a large proportion of these are either students or workers with other jobs.

Motorcycle repair shops generally are well-lighted and ventilated, but are noisy when engines are being tested. The work is not hazardous, although mechanics are subject to cuts, bruises, burns, and other minor injuries. Since motorcycles are relatively lightweight and have easily accessible parts, mechanics rarely do heavy lifting or work in awkward positions.

A small percentage of motorcycle mechanics are members of the International Association of Machinists and Aerospace Workers.

Sources of Additional Information

For further information regarding employment opportunities and training, contact local motorcycle dealers or the local office of the State employment service.

PIANO AND ORGAN TUNERS AND REPAIRERS

(D.O.T. 730.281, .381, and 829.281 and .381)

Nature of the Work

Pianos and organs are used to perform music ranging in style from contemporary "rock" to the classics of Bach. However, not even the greatest artist can overcome the handicap of an untuned instrument. Piano and organ tuners and repairers bring the notes of these instruments into harmony.

Piano tuner adjusting strings for proper pitch.

There are four different kinds of piano and organ tuners and repairers: Piano tuners, piano technicians, pipe organ technicians, and electronic organ technicians. According to their skills, they tune, repair, or rebuild pianos and organs. They usually begin their trade by learning how to tune these keyboard instruments.

Piano tuners (D.O.T. 730.381) adjust piano strings so that they will be in proper pitch and sound musically correct. There are approximately 220 strings in the standard 88-key piano. After muting the strings on either side, the tuner uses a tuning hammer (also called a tuning lever or wrench) to tighten or loosen the string being tested until its frequency matches that of a standard tuning fork. The other strings are tuned in relation to the starting string.

Sometimes the tuner has to make minor repairs, such as replacing worn or broken hammers. However, major repairs are made by piano technicians.

In addition to knowing how to tune a piano, *piano technicians* (D.O.T. 730.281) can detect and correct other problems that may affect its sound. Technicians talk with the customer to get an idea of what is wrong and then go to work to find out why. Once they find what the problem is, they make repairs or adjustments such as realigning hammers that do not strike the strings just right or replacing moth-eaten felt on the hammers. To dismantle and repair pianos, technicians use common handtools as well as special ones such as regulating tools, repinning tools, and key leveling devices.

Although organs and pianos look somewhat alike, they function differently, and few technicians work on both instruments. Moreover, organ technicians specialize in either electronic or pipe organs.

Pipe-organ technicians (D.O.T. 730.381) install, tune, and repair organs that make music by forcing air

through one of two kinds of pipes—flue pipes or reed pipes. The tone in a flue pipe, like that in a whistle, is made by air forced through an opening. The reed pipe makes its tone by vibrating a brass reed in the air current.

Like piano tuners, organ technicians use their ears and tuning forks to put an organ in good voice. To tune a flue pipe, the technician moves a metal slide that increases or decreases the pipe's "speaking length." A reed pipe is tuned by adjusting the length of the reed. A day or more may be needed to finish one of these jobs, because most organs have hundreds of pipes. Some workers specialize only in tuning, and do not have the all-round skills of a technician.

Most pipe organs are very large and complex, and are assembled on-site in places like churches and auditoriums. Technicians install air chests, blowers, air ducts, organ pipes, and other components. They follow the designer's blueprints and use a variety of hand and power tools to assemble components. Technicians may work in teams or be assisted by helpers. A job may take several weeks or even months, depending on the size of the organ.

Technicians may also maintain organs on a regular basis, returning every 3 or 4 months to tune them and make other routine adjustments.

Electronic organ technicians (D.O.T. 829.281) have very different duties from those of pipe organ technicians. They use special electronic test equipment to tune and to check tone and amplification. Some electronic organs do not require tuning. Those that do are fairly simple to tune. However, these organs may break down due to loose connections, faulty transistors, dirty contacts, and other problems. When routine checks do not find the problem, technicians use meters and electronic devices to check suspected circuits. For example, they check voltages until an unusual or irregular measure shows up the part of the circuitry causing trouble. When they find the problem, they make repairs or adjustments, using soldering irons, wire cutters, and other handtools. Technicians often use wiring diagrams and service manuals that show connections within organs, provide adjustment information, and describe causes of trouble. Because of the large differences among various brands of electronic organs, many technicians service only a particular brand.

Places of Employment

About 8,000 persons worked as full-time piano and organ tuners and repairers in 1976; most worked on pianos. About two-thirds of the total worked in independent repair shops; many were the sole operators of small shops. Another one-fifth were employed by piano and organ dealers. Most of the rest worked for piano and organ manufacturers.

Piano and organ tuners and repairers are employed mostly in big cities and in States that have large populations. In towns too small to offer enough work for a full-time job in this field, piano and pipe organ work may be done part time by local music teachers and professional musicians. Similarly, electronic organ work may be done by television and radio repairers.

Training, Other Qualifications, and Advancement

Piano and organ tuners and repairers generally learn on the job. Dealers and repair shops hire beginners to do general cleanup work, help move and install instruments, and do other routine tasks. Helpers gradually learn to tune and to make simple repairs, and then take on more difficult jobs as they gain experience. Generally, 3 to 4 years of on-the-job training are needed to qualify as a piano, pipe organ, or electronic organ technician.

Piano and organ manufacturers train inexperienced workers to assemble instruments. However, because assembly is done in many steps, workers learn little about the instrument as a whole, and need additional training in tuning and repair work before they can qualify as technicians.

People interested in a career in piano or organ servicing should have good hearing, mechanical aptitude, and manual dexterity. Because service work frequently is done in the customer's home, a neat appearance and a pleasant, cooperative manner also are important. Ability to play the instrument helps, but is not essential as a qualification.

Employers prefer high school graduates for beginning jobs in these fields. Music courses help develop the student's ear for tonal quality. Courses in woodworking also are useful because many of the moving parts in pianos and pipe organs are made of wood. For jobs as electronic organ technician trainees, applicants usually need formal training in electronics available from technical schools, junior and community colleges, and some technical-vocational high schools. Training in electronics also is available in the Armed Forces.

Courses in piano technology, which may take up to 2 years to complete, are offered by a small number of technical schools and by a few 4-year colleges. Home study (correspondence school) courses in piano and organ technology also are available.

Piano and organ tuners and repairers keep up with new developments in their fields by studying trade magazines and manufacturers' service manuals. Most electronic organ manufacturers and the Piano Technicians's Guild conduct brief courses periodically to provide information on technical changes in their instruments.

Tuners and repairers who work for large dealers or repair shops can advance to supervisory positions. Most people in this field move up, however, by going into business for themselves. Relatively little capital is required beyond an initial investment in tools. Basic piano or pipe organ tools cost only a few hundred dollars. By contrast, tools and test equipment for electronic organs may cost a thousand dollars or more. Typically, self-employed tuners and repairers operate out of their own homes and use either a car or a small truck for service calls.

Employment Outlook

Little change in the employment of piano tuners, piano technicians, and

pipe organ technicians is expected through the mid-1980's. Growth in the number of pianos and organs will be limited by competition from other forms of entertainment and recreation. Nevertheless, some jobs will open each year as experienced workers retire, die, or transfer to other occupations. Nearly all openings will be for piano tuners and technicians.

The continued growth in popularity of the electronic organ, a comparatively new instrument, is expected to produce a moderate increase in jobs for electronic organ technicians. However, this is a very small occupation and the number of job openings will be far fewer than for piano tuners and technicians.

Opportunities for beginners will be best in piano and organ dealerships and large repair shops. Many repair shops are too small to afford a full-time helper, although they may hire one helper part time.

Earnings and Working Conditions

Experienced workers earned from $5 to $10 an hour in 1976, depending on their level of skill and where they worked, according to limited information. Beginning rates for helpers ranged from $3 to $5 an hour.

Many self-employed tuners and repairers earned more than $12,000 a year, and earnings in excess of $15,000 a year were not uncommon. Earnings of the self-employed depend on the size of the community, their ability to attract and keep customers, their operating expenses, and competition from other tuners and repairers.

Service business increases with cold weather because at that time people spend more time indoors playing the piano or organ. Consequently, during fall and winter, many tuners and repairers work more than 40 hours a week. As business falls off during spring and summer, shops may take up the slack by reconditioning or rebuilding old instruments. Self-employed tuners and repairers frequently work evenings and weekends to suit their customers.

The work is relatively safe, although tuners and repairers may suffer small cuts and bruises when making repairs. Electrical shock is a minor hazard for electronic organ technicians but it has rarely caused serious injury. Work is performed in shops and homes and public buildings such as churches and schools where working conditions usually are pleasant.

Sources of Additional Information

Details about job opportunities may be available from local piano and organ dealers and repair shops. For general information about piano technicians and a list of schools offering courses in piano technology, write to:

Piano Technicians Guild, Inc., P.O. Box 1813, Seattle, Wash. 98111.

SHOE REPAIRERS

(D.O.T. 365.381)

Nature of the Work

People like their shoes to look nice and be in good condition. Keeping them that way is the job of the shoe repairer.

Shoe repairers spend most of their time replacing worn soles and heels. They remove worn soles and old stitching, and "rough" the bottom of the shoes on sanding wheels. They select precut soles or cut them from pieces of leather; they then cement, nail, or sew the soles to the shoes. Finally, they trim the soles. To reheel shoes, repairers pry off old heels, select replacement heels or cut them to shape, and cement and nail them into place. After the heels and soles have been replaced, repairers stain and buff them to match the color of the shoes.

Shoe repairers also replace insoles, restitch loose seams, and restyle old shoes by changing heels or dyeing uppers. Highly skilled repairers may design, make, or repair orthopedic shoes according to doctors' prescriptions. Repairers also may mend handbags, luggage, tents, and other items made of leather, rubber, or canvas. They also replace zippers, dye handbags, and stretch shoes to conform to the foot.

In large shops, repair work sometimes is divided into a number of specialized tasks. For example, some repairers only remove and replace heels and soles; others only restitch torn seams.

Shoe repairers use power-operated sole-stitchers and heel-nailing machines, and manually operated sewing machines. Among the handtools they use are hammers, awls, nippers, and skivers (a special tool for splitting pieces of leather).

Self-employed shoe repairers have managerial responsibilities in addition to their regular duties. They estimate repair costs, keep records, and supervise other repairers.

Places of Employment

About 25,000 shoe repairers were employed in 1976. About one-half of them owned shoe repair shops, many of which were small, one-person operations. Most of the remaining repairers worked in large shoe shops. Some repairers worked in shoe stores, department stores, and drycleaning shops. A small number were employed in shoe manufacturing, to repair shoes damaged in production. These workers generally are less skilled than those who work in repair shops.

All cities and towns and many very small communities have shoe repair shops. Employment, however, is concentrated in large cities.

Training, Other Qualifications, and Advancement

Most shoe repairers learn on the job as helpers to experienced repairers. Helpers begin by assisting experienced repairers with simple tasks, such as staining, brushing, and shining shoes. As they gain experience, trainees learn to replace heels and soles, to estimate the cost of repairs, and to deal with customers. Helpers usually become fully skilled in 2 to 3 years.

Some repairers learn the trade at vocational schools. Applicants to vocational schools usually must have a high school diploma. In addition to

Shoe repairer "roughs" bottom of shoe before attaching new sole.

learning shoe repairing, vocational school students attend classes in business administration. The programs last from 6 months to 2 years. Graduates often are encouraged to gain additional training by working with experienced shoe repairers.

Shoe repairers must have manual dexterity and mechanical aptitude to work with various machines and handtools. They must be able to work alone with little supervision. Shoe repairers need patience to perform the work and deal with customers. Repairers who own shops must have a working knowledge of basic arithmetic to maintain records.

Advancement opportunities for shoe repairers are limited. Many open their own shops and some who are employed in large shops become supervisors.

Employment Outlook

Employment of shoe repairers is not expected to change significantly through the mid-1980's. Nevertheless, numerous job openings are expected each year in this relatively small occupation, because of the need to replace experienced shoe repairers who retire, die, or leave the field for other reasons. Job opportunities should be very good because few people are attracted to this occupation. Opportunities should be especially good for experienced repairers who wish to open their own shops.

In recent years, employment of shoe repairers has declined because new shoes were relatively inexpensive and many people bought new shoes instead of having old ones fixed. This reduced the need for shoe repairs and repairers. The popularity of cushion-soled shoes and other casual footwear which usually are not practical to repair also limited the demand for these workers. However, shoe repairer employment is expected to remain about the same in the future. Expected shoe price increases should reduce the practice of replacing worn shoes with new shoes and should stimulate the demand for repairs.

Earnings and Working Conditions

Information from a limited number of employers indicates that shoe repairers earned between $3 and $4 an hour in 1976. Inexperienced trainees generally earned between $2.30 and $2.50 an hour. Some highly skilled repairers, including managers of shoe repair shops, earned more than $300 a week.

Shoe repairers generally work 8 hours a day, 5 days a week. The workweek for the self-employed is often longer, sometimes 10 hours a day, 6 days a week. Although shoe repair shops are busiest during the spring and fall, work is steady with no seasonal layoffs.

Because many shoe repairers own shops, working conditions are determined by the repairer. Large shops are usually comfortable, but small shops may be crowded and noisy and have poor light or ventilation. Strong odors from leather goods, dyes, and stains may be present.

The work is not strenuous and there are few hazards. However it does require stamina, because repairers must stand much of the time.

Sources of Additional Information

Information about training opportunities may be obtained from:

Shoe Service Institute of America, 222 W. Adams St., Chicago, Ill. 60606.

Information about work opportunities is available from State employment service offices, as well as shoe shops in the community.

TELEVISION AND RADIO SERVICE TECHNICIANS

(D.O.T. 720.281)

Nature of the Work

Television and radio service technicians repair a large and growing number of electronic products, of which television sets and radios are the most numerous. They also repair stereo components, tape recorders, intercoms, and public address systems. Some service technicians specialize in repairing one kind of equipment—for example, television sets or car radios.

Equipment may operate unsatisfactorily or break down completely because of faulty tubes or transistors, poor connections, or other problems. Service technicians check and evaluate each possible cause of trouble; they begin by checking for the most common cause—tube or module failure. In other routine checks, they look for loose or broken connections and for parts that are charred or burned.

When routine checks do not locate the trouble, technicians use test equipment, such as voltmeters, oscilloscopes, and signal generators, to check suspected circuits. For example, they may measure voltages or wave forms in a television set until an unusual or irregular measurement indicates the faulty part. Once the cause of trouble is found, they replace faulty parts and make adjustments, such as focusing and converging the picture or correcting the color balance.

Technicians who make customer service calls carry tubes, modules, and other parts that can be easily replaced in the customer's home. Radios, portable television sets, and other small equipment usually are repaired in service shops. Large television sets also are repaired in shops when the trouble must be located with complex test equipment.

Service technicians use screwdrivers, pliers, wire cutters, soldering irons, and other handtools. They refer to wiring diagrams and service manuals that show connections and provide information on how to locate problems and make repairs.

TV and radio service technicians use various instruments to locate faulty operations.

Places of Employment

About 114,000 people worked as radio and television service technicians in 1976. About one-quarter of them were self-employed, a much larger proportion than in most skilled trades. Two-thirds of all service technicians, either self-employed or working for others, worked in shops and stores that sell or service television sets, radios, and other electronic products.

Television and radio service technicians work in almost every city. Geographically, employment is distributed in much the same way as the Nation's population.

Training, Other Qualifications, and Advancement

Training and experience in electronics are required in order to become a skilled television and radio service technician. Technical, vocational, or high school training in electronics, mathematics, schematic reading, and physics may provide a good background for entering the field. The military services offer training and work experience that are very useful in civilian electronics work. Correspondence school courses also are helpful.

Up to 2 years of technical training in electronics plus 2 to 4 years of on-the-job experience usually are required to become a fully qualified service technician. People who have no previous technical training may be hired as helpers or apprentices if they show aptitude for the work or, like the amateur "ham" radio operator, have a hobby in electronics. An apprenticeship program lasts about 4 years and may include home study. The apprentice must work with a fully qualified service technician who is responsible for his work.

An important part of the service technician's training is provided by many manufacturers, employers, and trade associations. They conduct training programs to keep service technicians abreast of the latest servicing methods for new models or products. Technicians also keep up

with technical developments by studying manufacturers' service manuals and technical magazines and by attending training seminars. Technicians who work for large companies work mainly on that companies products and so are more familiar with certain brands.

Television and radio service technicians must know how electronic components and circuits work. Other essential qualifications include the ability to manipulate small parts and tools, good eye-hand coordination, normal hearing, good eyesight and color vision, and an ability to work with people.

Service technicians who work in large repair shops may be promoted to supervisor or service manager. Technicians who have sufficient funds may open their own sales and service shops. Some technicians obtain jobs as electronic "trouble shooters" or technicians in manufacturing industries or government agencies.

People interested in advancing to positions such as electronics technician can improve their opportunities by taking trade school, correspondence, or technical institute courses in automatic controls, electronic engineering, television engineering, and mathematics. Those planning to go into business for themselves should take some business administration courses, particularly accounting and consumer relations.

A growing number of States require radio and television technicians to be licensed. To obtain a license, applicants must pass an examination designed to test their knowledge of electronic circuits and components and their skill in the use of testing equipment.

Employment Outlook

Employment of television and radio service technicians is expected to increase faster than the average for all occupations through the mid-1980's. In addition to openings from employment growth, many openings will result each year from the need to replace experienced technicians who retire, die, or change occupations.

Employment of service technicians is expected to increase in response to the growing number of radios, television sets, phonographs, tape recorders, and other home entertainment products, despite the improvements in technology making repair of these products less necessary. Rising population and personal incomes will contribute to this growth. Nearly all households have at least one television set, and the number of households with two sets or more is expected to increase significantly, mainly because of the growing demand for color and portable sets. Greater use of electronic products for purposes other than entertainment also is expected; for example, closed-circuit television, two-way radios, calculators, home appliances, and various medical electronic devices. Closed-circuit television is being used increasingly to monitor production processes in manufacturing plants and to bring educational programs into classrooms.

People who enter the occupation should have steady work because the television and radio repair business is not very sensitive to changes in economic conditions.

Earnings and Working Conditions

Earnings of television and radio service technicians ranged from $3.50 to $7.50 an hour in 1976, based on the limited information available. The wide variations in wage rates reflect differences in skill level, type of employer, and geographic location.

Television and radio service technicians employed in local service shops or dealer service departments usually work 40 to 48 hours a week.

Service on television, radio, and other home entertainment products is performed in shops and homes, where working conditions usually are pleasant. Some physical strain is involved in lifting and carrying equipment. Hazards include electrical shock and the risk of falling from roofs while installing or repairing antennas.

Some service technicians are members of labor unions. Most of them belong to the International Brotherhood of Electrical Workers.

Sources of Additional Information

For more information about jobs in this field, contact local shops and stores that service television sets and radios and other electronic equipment. Technical and vocational schools that offer courses in television and radio repair or electronics may provide information about training. In addition, the local office of the State employment service may have information about programs that provide training opportunities.

Information about the work of television and radio service technicians is available from locals of the International Brotherhood of Electrical Workers and from:

National Alliance of Television and Electronic Service Associations, 5908 S. Troy St., Chicago, Ill. 60629.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

TRUCK MECHANICS AND BUS MECHANICS

(D.O.T. 620.281)

Nature of the Work

Commercial vehicles serve an important function in the Nation's economy. Heavy trucks are used by industries, such as mining and construction to carry ore and building materials, while small trucks are used for local hauling. Buses are used for both local and transcontinental transportation, as well as for shipping some goods. Truck and bus mechanics perform the vital role of keeping these vehicles in good operating condition.

Truck and bus mechanics work on both diesel and gasoline engines. However, most mechanics usually repair only one type, because many of the engine components are different. (See the statement on diesel mechanics elsewhere in the *Handbook*.)

Mechanics who work for organizations that maintain their own vehicles may spend much time doing preventive maintenance to assure safe op-

Some truck and bus mechanics specialize in the repair of diesel engines.

eration, to prevent wear and damage to parts, and to reduce costly breakdowns. During a maintenance check, they usually follow a regular check list that includes the inspection of brake systems, steering mechanisms, wheel bearings and other important parts. If a part is not working properly, they usually can repair or adjust it. If it cannot be fixed, it is replaced.

In many shops mechanics do all kinds of repair work. For example, they may work on a vehicle's electrical system one day and do major engine repair the next. In some large shops, however, mechanics specialize in one or two types of repair work. For example, one mechanic may specialize in major engine repair, another in transmission work, another in electrical systems and yet another in suspension or brake systems.

Truck and bus mechanics use a variety of tools in their work. They use power tools such as pneumatic wrenches to remove bolts quickly; machine tools such as lathes and grinding machines to rebuild brakes and other parts; welding and flame cutting equipment to remove and repair mufflers and other parts; common handtools such as screwdrivers, pliers, and wrenches to work on small parts and reach hard-to-get-to places; and jacks and hoists to lift and move large parts.

Truck and bus mechanics also use a variety of testing equipment. For example, when working on electrical systems, they may use ohmmeters, ammeters, and voltmeters; to locate engine malfunctions, they often use dynamometers.

For heavy work, such as removing engines and transmissions, two mechanics may work as a team, or a mechanic may be assisted by an apprentice or helper. Mechanics generally get their assignments from shop supervisors or service managers who may check the mechanics work or assist in diagnosing problems.

Places of Employment

A large proportion of the estimated 125,000 truck mechanics employed in 1976 worked for firms that owned fleets of trucks. Fleet owners include trucking companies and businesses that haul their own products such as dairies and bakeries. Other employers include truck dealers, truck manufacturers, truck repair shops, firms that rent or lease trucks, and Federal, State, and local governments.

Most of the estimated 20,000 bus mechanics employed in 1976 worked for local transit companies and intercity buslines. Bus manufacturers employed a relatively small number of mechanics.

Truck and bus mechanics are employed in every section of the country, but most work in large towns and cities where trucking companies, buslines, and other fleet owners have large repair shops.

Training, Other Qualifications, and Advancement

Most truck or bus mechanics learn their skills on the job. Beginners usually do tasks such as cleaning parts, fueling, and lubrication. They may also drive vehicles in and out of the shop. As beginners gain experience and as vacancies become available, they usually are promoted to mechanics' helpers. In some shops, beginners—especially those having prior automobile repair experience—start as mechanics' helpers.

Most helpers can make minor repairs after a few months experience and advance to increasingly difficult jobs as they prove their ability. Generally, 3 to 4 years of on-the-job experience are necessary to qualify as an all-round truck or bus mechanic. Additional training may be necessary for mechanics who wish to specialize in diesel engines.

Most training authorities recommend a formal 4-year apprenticeship as the best way to learn these trades. Typical apprenticeship programs for truck and bus mechanics consist of approximately 8,000 hours of shop training in which trainees obtain practical experience working on transmissions, engines, and other components and at least 576 hours of classroom instruction in which trainees learn blueprint reading, mathematics, engine theory and safety. Frequently, these include training in both diesel and gasoline engine repair.

For entry jobs, employers generally look for applicants who have mechanical aptitude, are at least 18 years of age, and in good physical

condition. Completion of high school is an advantage in getting an entry mechanic job because most employers believe it indicates that a person has at least some of the traits of a good worker, such as reliability and perseverance. Employers do not want to spend a lot of time and money training mechanics only to see them quit.

When the mechanic's duties include driving trucks or buses on public roads, applicants may need a State chauffeur's license. If the employer is engaged in interstate transportation, applicants also may have to meet qualifications for drivers established by the U.S. Department of Transportation. These applicants must be at least 21 years of age, in good physical condition, and have good hearing and 20/40 eyesight with or without glasses. They must read and speak English and have a good driving record, including 1 year's driving experience.

Persons interested in becoming truck or bus mechanics can gain valuable experience by taking high school or vocational school courses in automobile and diesel repair. Science and mathematics are helpful since they better one's understanding of how trucks and buses operate. Practical experience in automobile repair from working in a gasoline service station, the Armed Forces, or as a hobby also is valuable.

Most mechanics must buy their own handtools. Experienced mechanics often invest several hundred dollars in tools.

Employers sometimes send experienced mechanics to special training classes conducted by truck, bus, diesel engine, and parts manufacturers. In these classes, mechanics learn to repair the latest equipment or receive special training in subjects such as diagnosing engine malfunctions. Mechanics also may read service and repair manuals to keep abreast of engineering changes.

Experienced mechanics who have leadership ability may advance to shop supervisors or service managers. Truck mechanics who have sales ability sometimes become truck sales representatives. Some mechanics open their own gasoline service stations or repair shops.

Employment Outlook

Employment of truck mechanics is expected to increase about the same as the average for all occupations through the mid-1980's as a result of significant increases in the transportation of freight by trucks. More trucks will be needed for both local and intercity hauling due to the increased production of goods and the necessity of transporting them greater distances and to more places as both population and industrial centers spread out. In addition to the jobs created by employment growth, many openings will arise to replace truck mechanics who retire, die, or transfer to other occupations.

Bus mechanic employment is expected to increase slower than the average for all occupations through the mid-1980's because of offsetting factors affecting the demand for bus service. More buses will be needed for local travel due to increased emphasis on mass transit systems. Intercity bus travel, on the other hand, is expected to remain about the same. Most job openings will result from the need to replace bus mechanics who retire, die, or transfer to other occupations.

Earnings and Working Conditions

Truck and bus mechanics employed by trucking companies, buslines, and other firms that maintain their own vehicles had estimated average hourly earnings of $6.53 in 1976. By comparison, nonsupervisory workers in private industry, except farming, averaged $4.87.

Beginning apprentices usually earn one-half the rate of skilled workers and receive increases about every 6 months until a rate of 90 percent is reached.

Most mechanics work between 40 and 48 hours per week. Because many truck and bus firms provide service around the clock, mechanics who work for these firms may work evenings, nights, and weekends. When they do, they usually receive a higher rate of pay.

Truck mechanics and bus mechanics are subject to the usual shop hazards such as cuts and bruises. Mechanics handle greasy and dirty parts and may stand or lie in awkward or cramped positions when repairing vehicles. Work areas usually are well lighted, heated, and ventilated, and many employers provide locker rooms and shower facilities. Although most work is done indoors, mechanics occasionally work or make emergency repairs on the road.

Many truck and bus mechanics are members of labor unions, including the International Association of Machinists and Aerospace Workers; the Amalgamated Transit Union; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the Transport Workers Union of America; the Sheet Metal Workers' International Association; and the International Brotherhood of Teamsters, Chauffers, Warehousemen and Helpers of America (Ind.).

Sources of Additional Information

More details about work opportunities for truck or bus mechanics may be obtained from local employers such as trucking companies, truck dealers, or bus lines; locals of unions previously mentioned; or the local office of the State employment service. The State employment service also may have information about apprenticeship and other training programs.

For general information about the work of truck mechanics and apprenticeship training, write to:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

VENDING MACHINE MECHANICS

(D.O.T. 639.381)

Nature of the Work

Vending machines have become a familiar scene in everyday life. In places of recreation, work, and edu-

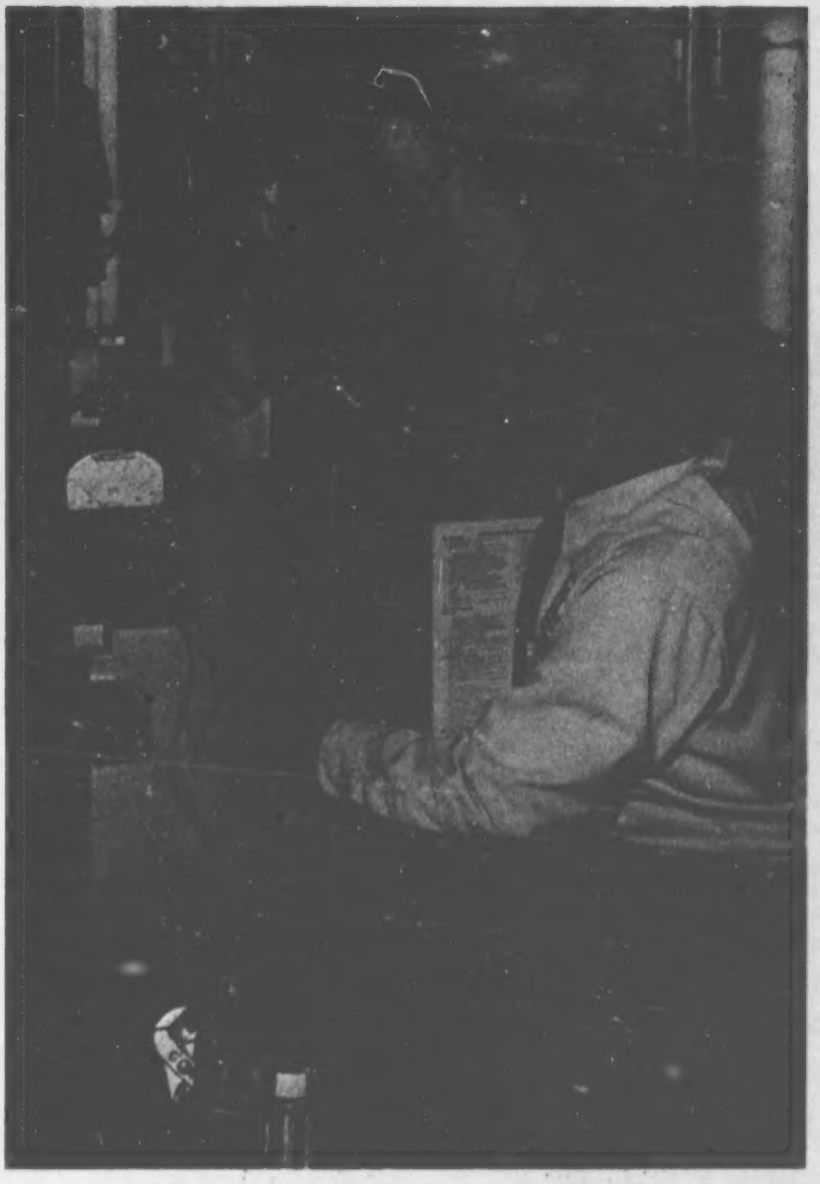
cation, vending machines provide everything from a piece of candy to a full-course meal.

Vending machine mechanics keep these machines in good working order. They also may assemble and install machines and, in some cases, stock them with merchandise. Some mechanics work only in repair shops and some work only in the field, but many do both. Those who work in the field are assigned a service truck to travel between locations.

In preparing machines for installation, mechanics follow instructions supplied by the manufacturer. After the machine is put together and tested, the mechanic fills it with products or ingredients and gives it a test run. When working on complicated machines, such as beverage or food dispensers, mechanics check to see that the machines give proper quantities of ingredients and that refrigerating and heating units work properly. On gravity-operated machines, mechanics check springs, plungers, and merchandise delivery systems. They also test coin and change-making mechanisms. When installing machines on location, mechanics make the necessary water and electrical connections and recheck the machines for proper operation.

Preventive maintenance—avoiding trouble before it starts—is another major part of the job. For example, mechanics periodically clean electrical contact points, lubricate mechanical parts, and adjust machines to perform properly. When a machine breaks down, mechanics must determine the cause of the trouble. They first inspect the machine for obvious problems, such as loose electrical wires, malfunctions of the coin mechanism, and leaks. If the problem cannot be readily located, they may refer to troubleshooting manuals and wiring diagrams and use testing devices such as electrical circuit testers to find defective parts. Mechanics then repair or replace the faulty parts, either on location or in the employer's service shop.

Mechanics use pipe cutters, soldering irons, wrenches, screwdrivers, hammers, and other handtools. In the shop, they also may use power tools, such as grinding wheels, saws, and drills.



Preventive maintenance is a major part of the job of vending machine mechanics.

Mechanics who install and repair food vending machines must know State public health and sanitation standards as well as those established under local plumbing codes. They also must know and follow safety procedures, especially when lifting heavy objects and working with electricity and gas.

Mechanics must do some clerical work, such as filing reports, preparing repair cost estimates, and ordering parts. Those employed by small operating companies frequently service as well as repair machines. These combination "mechanic-routeworkers" stock machines, collect money, fill coin and currency changers, and keep daily records of merchandise distributed. (Additional information about vending machine route drivers is included in the statement on route drivers elsewhere in the *Handbook*.)

Places of Employment

In 1976, about 25,000 mechanics maintained and repaired more than 5 million vending machines. Most mechanics work for vending service companies that install machines and provide services, such as cleaning, stocking, and repairing. Other mechanics work for beverage companies that have coin-operated machines or for companies that own and operate juke boxes, pin-ball machines, and laundry and drycleaning machines. Some mechanics are employed as instructors by vending machine manufacturers to explain technical innovations and ways to repair new machines to other mechanics. Although mechanics are employed throughout the country, most are located in industrial and commercial centers where there are a large number of vending machines.

Training, Other Qualifications, and Advancement

Persons usually enter this trade as general shop helpers or vending machine route drivers. If shop helpers or route drivers show promise as mechanics, they may become trainees. Some workers are hired directly as mechanic trainees.

Most trainees learn the trade informally on the job by observing, working with, and receiving instruction from experienced mechanics. Trainees usually start out by doing simple jobs such as cleaning, painting, or refurbishing machines. From there, they move on to rebuilding these machines—removing defective parts, repairing and adjusting them, and testing the machines. Next, they go on service calls, accompanying an experienced mechanic, and then go out on their own, calling upon the expertise of highly skilled mechanics or manufacturers' field engineers when necessary. At this point they have completed their on-the-job training. This process takes from 6 months to 3 years, depending on the individual's capabilities, previous education, and the quality of instruction. Some employers encourage both trainees and experienced mechanics to take evening courses in subjects related to machine operation and repair—for example, basic electricity and refrigeration. Employers often pay for at least part of the tuition and book expenses for these courses.

To learn about new and complex machines, employees sometimes attend manufacturer-sponsored training sessions. Instruction takes place either in manufacturers' service divisions in major cities or in operators' repair shops. Employers usually pay wages and expenses during these sessions, which may last from a few days to several weeks.

Many beginners are high school graduates, but employers generally do not require a diploma. High school or vocational school courses in electricity, refrigeration, and machine repair help beginners to qualify for entry jobs and may help beginners to skip the lowest rung of the job ladder—general shop helper. There are now 15 high schools and colleges in the country offering 1- to 2-year training programs in vending machine mechanics.

Employers require applicants to demonstrate mechanical ability, either through their work experience or by scoring well on mechanical aptitude tests. Since mechanics are exposed to thousands of dollars in merchandise and cash, employers will hire only applicants who have a record of honesty and respect for the law. The ability to deal tactfully with people also is important. A commercial driver's license and a good driving record are essential for most vending machine repair jobs.

Skilled mechanics may be promoted to senior mechanic or, in large companies, to shop supervisor. Advancement to service manager, who schedules repair work, is possible for mechanics having administrative ability.

Employment Outlook

Vending machine business will increase as population grows and as more industrial plants, hospitals, stores, and other establishments move to suburban areas where restaurants are not always close by. Growth in the number of vending machines will create more jobs for mechanics.

However, employment of vending machine mechanics is expected to grow more slowly than the average for all occupations through the mid-1980's. Most job openings will arise as a result of the need to replace experienced mechanics who retire, die, or transfer to other occupations. Because this is a small occupation, the number of openings will be relatively small.

Earnings and Working Conditions

Wage rates for vending machine mechanics ranged from $3.45 to $6.56 an hour in 1976, based on information from a small number of union contracts.

Most vending machine mechanics work 8 hours a day, 5 days a week, and receive premium pay for overtime. Since vending machines can be operated around the clock, mechanics sometimes work at night and on weekends and holidays. Some union contracts stipulate higher pay for nightwork and for emergency repair jobs on weekends and holidays.

Vending machine repair shops generally are quiet, well-lighted, and have adequate workspace. However, when servicing machines on location, mechanics may work in cramped quarters, such as passageways, where pedestrian traffic is heavy. Repair work is relatively safe, although mechanics are subject to shop hazards such as electrical shocks and cuts from sharp tools and metal objects.

Many vending machine mechanics employed by large companies are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America.

Sources of Additional Information

Further information on job opportunities can be obtained from local vending machine operators and local offices of the State employment service. For general information on vending machine mechanics, as well as a list of schools offering courses in vending machine mechanics, write to:

National Automatic Merchandising Association, 7 S. Dearborn St., Chicago, Ill. 60603.

WATCH REPAIRERS

(D.O.T. 715.281)

Nature of the Work

As the pace of modern living quickens, people become more conscious of time and more dependent on watches and clocks to keep appointments and complete tasks. Cleaning, repairing, and adjusting these devices is the job of watch repairers or, as they are frequently called, watchmakers.

When a watch is not working properly, repairers use tweezers, screwdrivers, and other tools to remove the watch from its case and disassemble the movement. With the aid of a special magnifying glass called a loupe, they carefully examine each part of the mechanism.

Repairers may replace the mainspring and other parts of the winding mechanism of a mechanical watch or the battery of an electronic watch. They may adjust improperly fitted wheels, and replace broken hands or a cracked watch crystal. Before reassembling the watch, watch repairers clean and oil its parts, then test its accuracy with a timing machine.

In addition to handtools, watch repairers use timing and cleaning machines. They use electrical test equipment when repairing electronic watches to make sure that circuits work properly.

Watch repairers who own jewelry stores may do jewelry repair and sell watches, jewelry, silverware, and other items. They also may hire and supervise salesclerks, other watch repairers, and jewelers; arrange window displays; purchase goods to be sold; and perform other managerial duties.

Places of Employment

About 21,000 persons worked as watch repairers in 1976. One-third were self-employed. Most watch repairers worked in jewelry stores or repair shops, which are located throughout the country. A small number had jobs in factories that make watches, clocks, or other precision timing instruments.

Training, Other Qualifications, and Advancement

Most people learn the trade in watch repair schools; others learn through formal apprenticeship or informal on-the-job training arrangements.

There generally are no specific educational requirements for entrance into watch repair schools although most students are high school graduates. Some schools test a student's mental aptitude and manual dexterity. Most schools charge tuition and require students to furnish their own handtools. Courses last from 1 to 3 years for full-time students. Students learn to use and care for the watch repairer's tools and machines, make and adjust individual parts, take apart and reassemble various kinds of watch and clock movements, and diagnose and solve repair problems. Some schools offer courses on repairing unusual types of timepieces, such as chronographs and timers.

Some watch repairers learn the trade through formal apprenticeships. Apprentices should have a high school diploma. They receive some classroom instruction in watch technology, however, most of their training is conducted on-the-job. The training is structured in much the same way as the technical school courses. Apprenticeships last 3 to 4 years. Instructing an apprentice requires a great deal of time; for this reason many watch repairers are reluctant to employ a trainee. Only 100 apprenticeships were registered with the Department of Labor in 1975.

A few watch repairers acquire their skills through informal on-the-job arrangements with experienced workers. This type of training is less structured than apprenticeship, and classroom instruction is not required. Trainees learn by observing experienced repairers and by performing simple and then more complex repairs. On-the-job training lasts longer than technical school or apprenticeship.

The following States require watch repairers to obtain a license: Florida, Indiana, Iowa, Kentucky, Louisiana, Michigan, Minnesota, North Carolina, North Dakota, Oregon, and Wisconsin. To obtain a license, repairers must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair.

Watch repairers in all States can demonstrate their competence by passing certification examinations given by the American Watchmakers Institute. Tests are given for the title of either Certified Watchmaker or Certified Master Watchmaker. Annual voluntary examinations covering new phases of watchmaking also are offered, and those who pass are given a plaque of recognition.

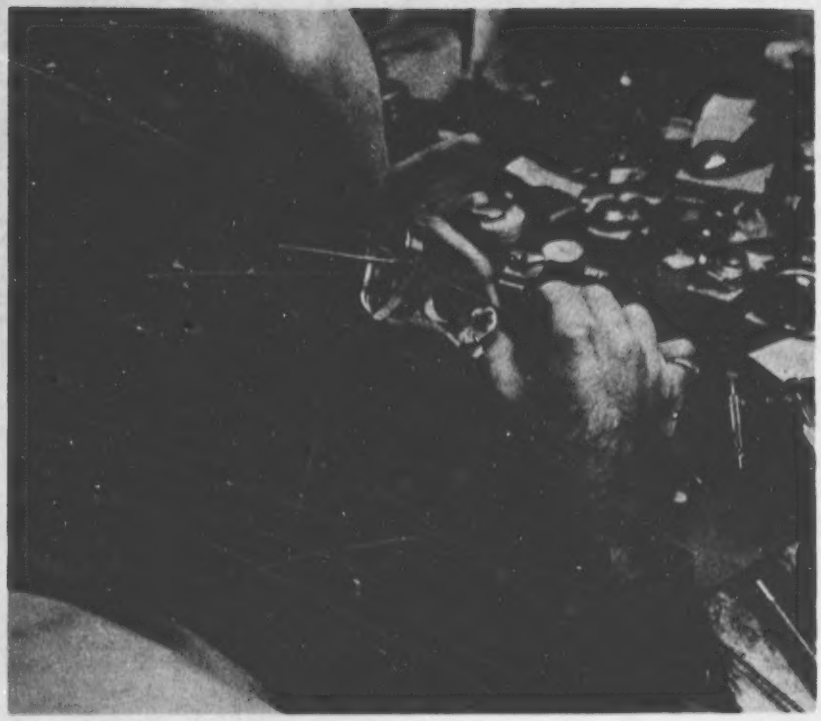
A person planning a career as a watch repairer must be willing to sit for long periods and work with a minimum of supervision. The precise and delicate nature of the work requires patience and concentration. Since a watch is simply a small machine, mechanical aptitude is essential. Good depth perception and eye-hand coordination are essential in working with the tiny parts.

Watch repairers who have sufficient experience and funds may open their own watch repair shops. Watch repairers also may open their own jewelry stores where they can increase their income by selling watches and other merchandise in addition to repairing watches. These stores require a much greater financial investment than do repair shops, because an inventory of expensive merchandise must be obtained.

Employment Outlook

Employment of watch repairers is expected to grow at a slower rate than the average for all occupations through the mid-1980's. Most job openings will result from the need to replace experienced repairers who retire, die, or leave the occupation for other reasons. Job opportunities should be very good for trained watch repairers.

Although more watches will be sold as population and incomes rise, many will be inexpensive watches that cost little more to replace than repair. Consequently, employment is not expected to keep pace with growth in the number of watches.



Watch repair work requires patience and concentration.

Furthermore, the increasing popularity of solid-state digital watches may lower the need for watch repairers. These watches have no moving parts and usually are serviced by factory technicians instead of watch repairers. However, in recent years job openings have exceeded the number of trained workers entering the occupation. If this gap continues, trained workers should find jobs readily available. Opportunities are expected to be particularly good for graduates who have had training in repairing electronic watches because these watches are growing in popularity.

Earnings and Working Conditions

Earnings of watch repairers in entry jobs generally ranged from about $150 to $200 for a 40-hour week in 1976, based on the limited information available. Experienced watch repairers working in retail stores and repair shops received from $275 to $350 for a 40-hour week. Some watch repairers may be paid a commission based on the number of watches repaired. Others rent space in a jewelry store set up a repair department, and split the profits with the store owner. Watch repairers who are paid commission or own their own businesses can earn considerably more than those working for a salary.

Watch repairers often work longer than the standard 40-hour week. Those who are self-employed or located in small communities often work a 48-hour week or longer. The work involves little physical exertion, however, and generally is performed in comfortable surroundings.

Sources of Additional Information

For information about training courses and watch repairing as a career, contact:

American Watchmakers Institute, P.O. Box 11011, Cincinnati, Ohio 45211.

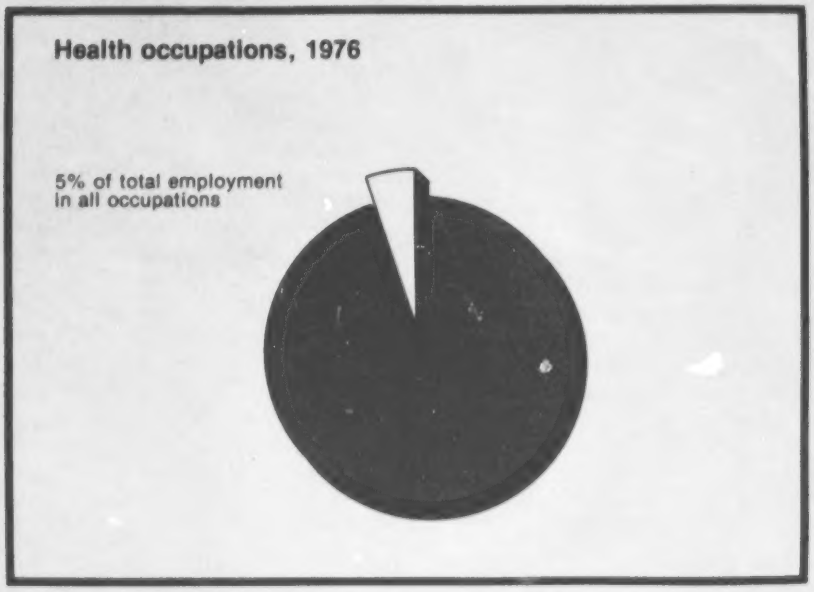
For information about job opportunities in retail stores contact:

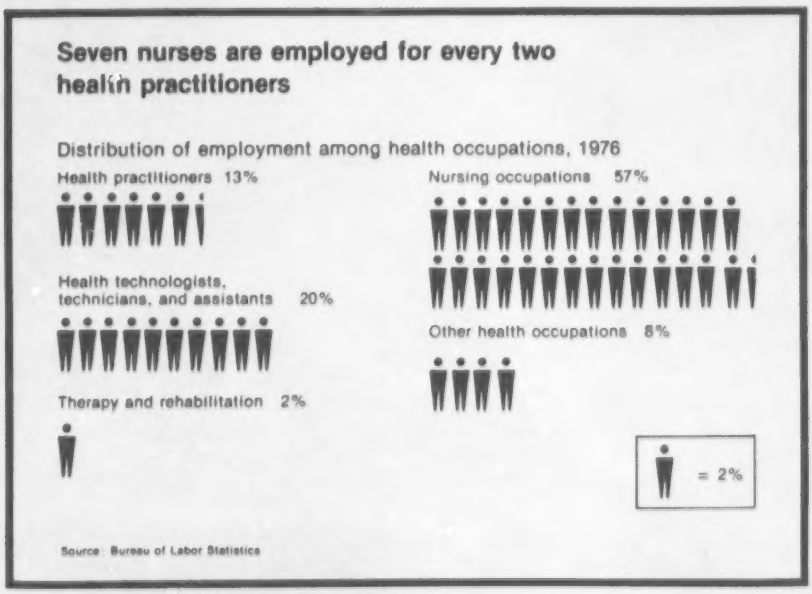
Retail Jewelers of America, Inc., 10 Rooney Circle, West Orange, N.J. 07052.

Further information about work opportunities or training in this trade also is available from local offices of the State employment service.

HEALTH OCCUPATIONS

When people are sick or injured, having health services readily available becomes very important to them. The availability of these services depends, not only on the number of people employed in health occupations, but also on their geographic distribution. The number of health personnel has grown very rapidly in recent years; improving their distribution remains a problem that is being attacked on the national, State, and local levels.




Seven nurses are employed for every two health practitioners
Distribution of employment among health occupations, 1976
Health practitioners 13%
Nursing occupations 57%
Health technologists, technicians, and assistants 20%
Other health occupations 8%
Therapy and rehabilitation 2%
= 2%
Source: Bureau of Labor Statistics

About 4.3 million people worked in health-related occupations in 1976. Besides doctors, nurses, dentists, and therapists, these include the behind-the-scenes technologists, technicians, administrators, and assistants.

Registered nurses, physicians, pharmacists, and dentists constitute the largest professional health occupations. In 1976 employment in these occupations ranged from 960,000 for registered nurses to 112,000 for dentists. Professional health occupations also include other medical practitioners—osteopathic physicians, chiropractors, optometrists, podiatrists, and veterinarians. Therapists (physical therapists, occupational therapists, and speech pathologists and audiologists) and administrators (health services administrators and medical record administrators) also are professional health workers, as are dietitians.

Other health service workers include technicians of various types, such as medical technologist, medical X-ray technician, dental hygienist, and dental laboratory technician. A large number—1.5 million—worked as practical nurses and auxiliary workers, including nursing aides, orderlies, hospital attendants, and psychiatric assistants.

Hospitals employ about half of all workers in the health field. Others work in clinics, laboratories, pharmacies, nursing homes, public health agencies, mental health centers, private offices, and patients' homes. Health workers are concentrated in the more heavily populated and prosperous areas of the Nation.

Training

The educational and other requirements for work in the health field are as diverse as the health occupations themselves. For example, professional health workers—physicians, dentists, pharmacists, and others—must complete a number of years of preprofessional and professional college education and pass a State licensing examination. On the other hand, some health service occupations can be entered with little specialized training. Many community and junior colleges offer courses to prepare students for various health jobs. In many occupations on-the-job training traditionally has been the means of preparation, but employers now prefer persons who have completed a formal educational program.

Earnings

Earnings of health workers range from those of a physician—the highest paid occupation—to those of a nursing aide, who earns only three-fourths of the average for all nonsupervisory workers in private industry, except farming. Earnings for the other health occupations that can be entered with up to 2 years of formal training are about the same as the average. People in health occupations that require graduation from college earn from one-and-a-quarter times to twice these average earnings. Among the occupations for which average yearly earnings are reported in the *Handbook*, the top 15 include 8 of the professional health occupations, including all 6 medical practitioners.

Outlook

Employment in the health field is expected to grow much faster than the average for all occupations through the mid-1980's, although the rates of growth will differ considerably among individual health occupations. Among the factors that are expected to contribute to an increase in the demand for health care are population growth and the public's increasing health consciousness. Expansion of coverage under prepayment programs that make it easier for persons to pay for hospitalization and medical care also will contribute to growth in this field. Other openings will be created each year by the increasing expenditures by Federal, State, and local governments for health care and services.

In addition to jobs created by employment growth, many new workers will be needed each year to replace those who retire, die, or leave the field for other reasons.

Recent expansion of training programs in most of the occupations will add to the supply of trained health service personnel. The employment outlook in the various occupations ranges from excellent to competitive, depending on the balance between the supply of workers and expected openings. See the individual statements for the outlook for each occupation.

DENTAL OCCUPATIONS

About 9 out of every 10 dentists are in private practice.

Proper dental care is an integral part of overall health care. This section focuses on the dental profession and the three dental auxiliary occupations.

Dentists examine and treat patients for oral diseases and abnormalities, such as decayed and impacted teeth. Most dentists are general practitioners, but some specialize in certain areas of dentistry, such as orthodontics or oral surgery. Other dentists are employed in teaching, research, or administration.

Dental hygienists are the only dental auxiliary workers required by each State to be licensed. They scale, clean, and polish teeth, expose X-rays, and instruct patients in proper oral hygiene.

Dental assistants help dentists while they are working with patients. This assistance includes things such as handing the dentist the necessary instruments, keeping the patient's mouth clear, and preparing materials for impressions of teeth. They also perform non-chairside duties such as keeping records, receiving patients, and ordering dental supplies.

Dental laboratory technicians make various dental and orthodontal appliances, such as dentures and crowns, according to the models and instructions supplied by dentists. This work requires patience, minute attention to detail, and a high degree of manual dexterity. Some technicians prepare all kinds of dental appliances, while others concentrate in certain areas of dental laboratory work, such as bridges or artificial teeth.

DENTISTS

(D.O.T. 072.108)

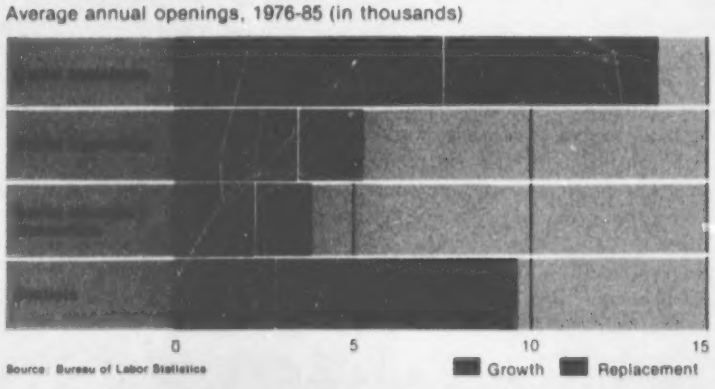
Nature of the Work

Dentists examine teeth and other tissues of the mouth to diagnose diseases or abnormalities. They take X-rays, fill cavities, straighten teeth, and treat gum diseases. Dentists extract teeth and substitute artificial dentures designed for the individual patient. They also perform corrective surgery of the gums and supporting bones. In addition, they may clean teeth.

Dentists spend most of their time with patients, but may devote some time to laboratory work such as making dentures and inlays. Most dentists, however—particularly those in large cities—send their laboratory work to commercial firms. Some dentists also employ dental hygienists to clean patients' teeth and provide instruction for patient self-care. (See statement on dental hygienists.) They also may employ other assistants who perform office work, assist in "chairside" duties, and provide therapeutic services under the supervision of the dentist.

Most dentists are general practitioners who provide many types of dental care; about 10 percent are specialists. The largest group of specialists are orthodontists, who straighten teeth. The next largest group, oral surgeons, operate on the mouth and jaws. The remainder specialize in pedodontics (dentistry for children); periodontics (treating the gums); prosthodontics (making artificial teeth or dentures); endodontics (root canal therapy); public health

Growing demand for dentists' services and expanded use of auxiliary workers will create good job opportunities in dental occupations



dentistry; and oral pathology (diseases of the mouth).

About 4 percent of all dentists teach in dental schools, do research, or administer dental health programs on a full-time basis. Many dentists in private practice do this work on a part-time basis.

Places of Employment

About 112,000 dentists were at work in the United States in 1976—9 of every 10 were in private practice. About 5,000 served as commissioned officers in the Armed Forces, and about 1,400 worked in other types of Federal Government positions—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service.

Training, Other Qualifications, and Advancement

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license in most States, a candidate must be a graduate of a dental school approved by the American Dental Association and pass written and practical examinations. In 1976, candidates in 48 States and the District of Columbia could fulfill part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. Most State licenses permit dentists to engage in both general and specialized practice. In 14 States, however, a dentist cannot be licensed as a "specialist" without having 2 or 3 years of graduate education and, in some cases, passing a special State examination. In the other 36 states, the extra education also is necessary, but a specialist's practice is regulated by the dental profession, not the State licensing authority. In order to practice in a different State, a licensed dentist usually must pass the State's examination. However, at least 21 States grant licenses without further examination to dentists already licensed in other States on the basis of their credentials. Dentists who want to teach or do research usually spend an additional 2 to 4 years in advanced dental training in programs operated by dental schools, hospitals, and other institutions of higher education.

Dental colleges require from 2 to 4 years of predental education. However, of those students entering dental school in 1976, 85 percent had a baccalaureate or master's degree. Predental education must include courses in the sciences and humanities.

Competition is keen for admission to dental schools. In selecting students, schools give considerable weight to college grades and the amount of college education. In addition, all dental schools participate in a nationwide admission testing program, and scores earned on these tests are considered along with information gathered about the applicant through recommendations and interviews. Many State-supported dental schools also give preference to residents of their particular States.

Dental school training generally lasts 4 academic years although some institutions condense this into 3 calendar years. Studies begin with an emphasis on classroom instruction and laboratory work in basic sciences such as anatomy, microbiology, biochemistry, and physiology. Courses in clinical sciences and preclinical technique also are provided at this time. The last 2 years are spent chiefly in a dental clinic, treating patients.

The degree of Doctor of Dental Surgery (D.D.S.) is awarded by most dental colleges. An equivalent degree, Doctor of Dental Medicine (D.M.D.), is conferred by 19 schools.

Dental education is very costly because of the length of time required to earn the dental degree. However, Federal funds provide a limited number of loans for dental students, and a limited number of scholarships are available for qualifying students who agree to a minimum of 2 years' Federal service.

The profession of dentistry requires both manual skills and a high level of diagnostic ability. Dentists should have good visual memory, excellent judgment of space and shape, and a high degree of manual dexterity, as well as scientific ability. Good business sense, self-discipline, and the ability to instill confidence are helpful for success in private practice. High school students who want to become dentists are advised to take courses in biology, chemistry, health, and mathematics.

Most dental graduates open their own offices or purchase established practices. Some start in practice with established dentists, to gain experience and to save the money required to equip an office; others may enter residency training programs in approved hospitals. Dentists who enter the Armed Forces are commissioned as captains in the Army and Air Force and as lieutenants in the Navy. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions (equivalent to lieutenants in the Navy) in the U.S. Public Health Service.

Employment Outlook

Employment opportunities for dentists are expected to be very good through the mid-1980's. Dental school enrollments have grown in recent years because of federally assisted construction of additional training facilities. However, unless schools expand beyond present levels, the number of new entrants to the field is expected to fall short of the number needed to fill openings created by growth of the occupation and by death or retirement from the profession.

Employment of dentists is expected to grow about as fast as the average for all occupations due to population growth, increased awareness that regular dental care helps prevent and control dental diseases, and the expansion of prepayment arrangements, which make it easier for people to afford dental services. Fluoridation of community water supplies and improved dental hygiene may prevent some tooth and gum disorders, and preserve teeth that might otherwise be extracted. However, since the preserved teeth will need care in the future, these measures may increase rather than decrease the demand for dental care. Similarly, while new techniques, equipment, and drugs, as well as the expanded

use of dental hygienists, assistants, and laboratory technicians should enable individual dentists to care for more patients, these developments are not expected to offset the need for more dentists.

There will continue to be a need for dentists to administer dental public health programs and teach in dental colleges. Also, many dentists will continue to serve in the Armed Forces.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to cover expenses, but their earnings usually rise rapidly as their practice develops. Specialists generally earn considerably more than general practitioners. The average income of dentists in 1976 was about $39,500 a year, according to the limited information available. In the Federal Government, new graduates of dental schools could expect to start at $17,056 a year in 1977. Experienced dentists working for the Federal Government in 1977 earned average annual salaries of $31,600, with some earning as much as $39,600 a year.

Location is one of the major factors affecting the income of dentists who open their own offices. For example, in high-income urban areas, dental services are in great demand; however, a practice can be developed most quickly in small towns, where new dentists easily become known and where they may face less competition from established practitioners. Although the income from practice in small towns may rise rapidly at first, over the long run the level of earnings, like the cost of living, may be lower than it is in larger communities.

Most dental offices are open 5 days a week and some dentists have evening hours. Dentists usually work between 40 and 45 hours a week, although many spend more than 50 hours a week in the office. Dentists often work fewer hours as they grow older, and a considerable number continue in part-time practice well beyond the usual retirement age.

Sources of Additional Information

Persons who wish to practice in a given State should obtain the requirements for licensure from the board of dental examiners of that State. Lists of State boards and of accredited dental schools, as well as information on dentistry as a career, is available from:

American Dental Association, Council on Dental Education, 211 East Chicago Ave., Chicago, Ill. 60611.

American Association of Dental Schools, 1625 Massachusetts Ave. NW., Washington, D.C. 20036.

Information on dentistry as a career also is available from:

Division of Dentistry, Public Health Service, U.S. Department of Health, Education, and Welfare, 9000 Rockville Pike, Bethesda, Md. 20014.

Students should contact the director of student financial aid at the school they attend for information about Federal or other loans and scholarships.

DENTAL ASSISTANTS

(D.O.T. 079.378)

Nature of the Work

Dental assistants work with dentists as they examine and treat patients. The assistant makes the patients comfortable in the dental chair, prepares them for treatment, and obtains their dental records. The assistant hands the dentist the proper instruments and materials and keeps the patient's mouth clear by using suction or other devices. Dental assistants prepare materials for making impressions and restorations and expose radiographs and process dental X-ray film as directed by the dentist. They also provide oral health instruction and prepare instruments for sterilization.

Dental assistants perform a variety of duties that do not require the dentist's professional knowledge and skill. Some assistants make casts of the teeth and mouth from impressions taken by the dentist. These casts are used by dentists and technicians to make dentures. In some States, assistants apply medicaments to the teeth and oral tissue, remove excess cement used in the filling process from surfaces of the teeth, and place rubber dams on the teeth to isolate them for individual treatment. Some dental assistants manage the office and arrange and confirm appointments, receive patients, keep treatment records, send bills, receive payments, and order dental supplies and materials.

The work of the dental assistant should not be confused with that of the dental hygienist, who must be licensed to scale and polish the teeth. (See statement on dental hygienists elsewhere in the *Handbook*.)

Places of Employment

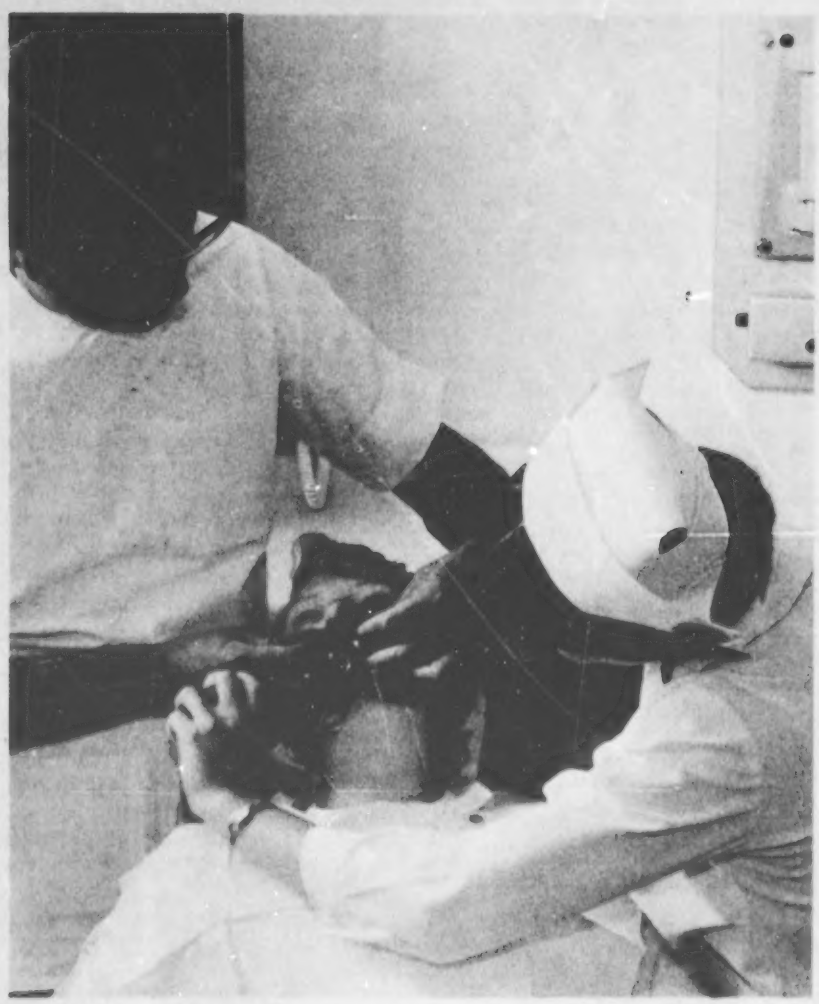
Nearly 135,000 persons worked as dental assistants in 1976; about 1 out of 10 work part time.

Most dental assistants work in private dental offices, either for individual dentists or for groups of dentists. Many of the remainder work in dental schools, hospital dental departments, State and local public health departments, or private clinics. The Federal Government employs dental assistants, chiefly in the Public Health Service, the Veterans Administration, and the Armed Forces.

Training, Other Qualifications, and Advancement

Most dental assistants learn their skills on the job. An increasing number, however, are trained in formal post-high school programs. About 280 such programs were accredited by the American Dental Association (ADA) in 1976.

Most post-high school courses in dental assisting are given in junior and community colleges or in vocational or technical schools. More than three-fourths of these programs take 1 year to complete and lead to a certificate or diploma. Graduates of 2-year programs offered in junior and community colleges earn an associate degree upon completion of specialized training and liberal arts courses. The minimum requirement



Most dental assistants learn their skills on the job.

for any of these programs is a high school diploma or its equivalent. Some schools also require typing or a science course for admission. Although some private schools offer 4- to 6-month courses in dental assisting, these are not accredited by the dental profession. Those receiving dental assistant training in the Armed Forces usually qualify for civilian jobs as dental assistants.

High school students interested in careers as dental assistants should take courses in biology, chemistry, health, typing, and office practices.

Approved dental assisting curriculums include classroom and laboratory instruction in skills and related theory. Trainees get practical experience in affiliated dental schools, local clinics, or selected dental offices.

A correspondence course accredited by the American Dental Association is available for employed dental assistants who are learning on the job or who otherwise are unable to participate in regular dental assisting programs on a full-time basis. The correspondence program is equivalent to 1 academic year of study, but generally requires about 2 years to complete.

Graduates of accredited dental assistant programs who successfully complete an examination administered by the Certifying Board of the American Dental Assistants Association become Certified Dental Assistants. Certification is acknowledgement of an assistant's qualifications but is not generally required for employment.

After working as dental assistants, some individuals seek to acquire skills and qualifications for practicing as dental hygienists. Prospective dental assistants who foresee this possibility should plan carefully since credit earned in a dental assistant program often is not applicable toward requirements for a dental hygiene certificate. Some dental assistants become sales representatives for firms that manufacture dental products.

Employment Outlook

Employment opportunities for dental assistants are expected to be excellent through the mid-1980's, especially for graduates of academic programs in dental assisting. Part-time opportunities also will be very favorable.

Employment of dental assistants is expected to grow much faster than the average for all occupations, largely because recent graduates of dental schools have been taught to use assistants in their practice. The increase in the demand for dental services which stems from population growth, a growing awareness of the importance of regular dental care, and the increasing ability of people to pay for care also will contribute to the demand for dental assistants. For example, increased participation in dental prepayment plans and public programs such as Medicaid bring dental services within the reach of many who could not afford them otherwise.

In addition to job openings created by growth in the demand for dental assistants, thousands of assistants also will be required each year to replace those who leave the field.

Earnings and Working Conditions

Salary depends largely on the assistant's education and experience, the duties and responsibilities attached to the particular job, and geographic location.

In the Federal Government, experience and the amount and type of education determine entrance salaries. In 1977, a high school graduate who had 6 months of general experience started at $7,408 a year; graduates of an ADA-approved 1-year training program who had an additional year of general experience could expect to start at $8,316 a year. In general, experienced dental assistants working for the Federal Government in 1977 earned average annual salaries of $9,100.

Although the 40-hour workweek prevails for dental assistants, the schedule is likely to include work on Saturday. A 2- or 3-week paid vacation is common. Some dentists provide sick leave and other benefits. Dental assistants who work for the Federal Government receive the same employee benefits as other Federal workers.

Dental assistants work in a well-lighted, clean environment. They must be careful in handling radiographic and other equipment.

Sources of Additional Information

Information about career opportunities, scholarships, accredited dental assistant programs, including the correspondence program, and requirements for certification is available from:

American Dental Assistants Association, 211 E. Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental assistants is available from:

Division of Dentistry, Public Health Service, U.S. Department of Health, Education, and Welfare, 9000 Rockville Pike, Bethesda, Md. 20014.

DENTAL HYGIENISTS

(D.O.T. 078.368)

Nature of the Work

Dental hygienists are oral health clinicians and educators who help the public develop and maintain good oral health. As members of the dental health team, dental hygienists may perform preventive and therapeutic services under the supervision of the dentist. Specific responsibilities of the hygienist vary, depending on the law of the State where the hygienist is employed, but may include: removing deposits and stains from patients' teeth; providing in-

Dental hygienists must be licensed.

structions for patient self-care, and dietetic and nutritional counseling; and the application of medicine for the prevention of tooth decay. They take medical and dental histories, expose and develop dental X-ray films, make model impressions of teeth for study, and prepare other diagnostic aids for use by the dentist. Pain control and restorative procedures also may be performed by dental hygienists in some States.

Dental hygienists who work in school systems serve in several capacities. Clinical functions include: examination of children's teeth, assistance to the dentist in determining the dental treatment needed, and reporting of their findings to parents. They also scale and polish teeth and give instruction on proper mouth care. In addition, they develop classroom or assembly programs on oral health.

A few dental hygienists assist in research projects. Those having advanced training may teach in schools of dental hygiene.

Places of Employment

Nearly 27,000 persons worked as dental hygienists in 1976. Many are employed part time. Most work in private dental offices. Public health agencies, school systems, industrial plants, clinics, hospitals, dental hygiene schools, and the Federal Government are other sources of employment for dental hygienists. Some who are graduates of bachelor's degree programs are commissioned officers in the Armed Forces.

Training and Other Qualifications

Dental hygienists must be licensed. To obtain a license in most States, a candidate must be a graduate of an accredited dental hygiene school and pass both a written and clinical examination. For the clinical examination, the applicant is required to perform dental hygiene procedures, such as removing deposits and stains from a patient's teeth. In 1976, candidates in 48 States and the District of Columbia could complete part of the State licensing requirements by passing a written examination given by the National Board of Dental Examiners. Few States permit dental hygienists licensed in other States to practice in their jurisdictions without further examination.

In 1976, 182 schools of dental hygiene in the United States were accredited by the American Dental Association. Most programs grant an associate degree; others lead to a bachelor's degree. Some institutions offer both types of programs. Eighteen schools offer master's degree programs in dental hygiene or related fields.

Completion of an associate degree program usually is sufficient for the dental hygienist who wants to practice in a private dental office. In order to do research, teach, and work in public or school health programs, at least a baccalaureate degree usually is required. Dental hygienists with a master's degree work as teachers or administrators in dental hygiene and dental assisting training programs, public health agencies, and in associated research.

Competition is keen for admission to dental hygiene schools. The minimum requirement for admission to a school of dental hygiene is graduation from high school. Several schools that offer the bachelor's degree admit students to the dental hygiene program only after they have completed 2 years of college. Many schools also require that applicants take an aptitude test given by the American Dental Hygienists' Association. Dental hygiene training given in the Armed Forces does not fully prepare one to pass the licensing exam, but credit for that training may be granted to those who seek admission to accredited dental hygiene programs.

The curriculum in a dental hygiene program consists of courses in the basic sciences, dental sciences, clinical science, and liberal arts. These schools offer laboratory, clinical, and classroom instruction in subjects such as anatomy, physiology, chemistry, pharmacology, nutrition, histology (the study of tissue structure), periodontology (the study of gum diseases), dental materials, and clinical dental hygiene.

People who want to become dental hygienists should be those who enjoy working with others. The ability to put patients at ease is helpful. Personal neatness and cleanliness, manual dexterity, and good health also are important qualities. Among the courses recommended for high school students interested in careers in this occupation are biology, health, chemistry, speech, and mathematics.

Employment Outlook

Employment opportunities for dental hygienists are expected to be good through the mid-1980's. Despite an anticipated rise in the number of graduates from schools of dental hygiene, the demand is expected to be greater than the number available for employment if recent trends in enrollments continue. There also should be very good opportunities for those desiring part-time employment, and for those willing to work in rural areas.

Employment of dental hygienists is expected to grow much faster than the average for all occupations, because of an expanding population and the growing awareness of the importance of regular dental care. Increased participation in dental prepayment plans and more group practice among dentists should result in new jobs for dental hygienists. Dental care programs for children also may lead to more employment opportunities in this field.

Earnings and Working Conditions

Earnings of dental hygienists are affected by the type of employer, education and experience of the individual hygienist, and the geographic location. Dental hygienists who work in private dental offices usually are salaried employees, although some are paid a commission for work performed, or a combination of salary and commission.

Dental hygienists working full time in private offices earned average

salaries of about $12,900 a year in 1976, according to the limited data available. This salary was slightly above the average for all nonsupervisory workers in private industry, except farming. In 1977, the Federal Government paid dental hygienists with no experience starting salaries of $8,316 a year. Experienced dental hygienists working for the Federal Government earned average annual salaries of $10,500.

Dental hygienists employed full time in private offices usually worked between 35 and 40 hours a week. They may work on Saturdays or during evening hours. Some hygienists work for two dentists or more.

Dental hygienists usually work in clean, well-lighted offices. Important health protections for persons in this occupation are regular medical checkups and strict adherence to established procedures for using X-ray equipment and for disinfection.

Dental hygienists who work for school systems, health agencies, and the Federal or State governments have the same hours, vacation, sick leave, retirement, and health insurance benefits as other workers in these organizations.

Sources of Additional Information

For information about accredited programs and the educational requirements to enter this occupation, contact:

Office of Education, American Dental Hygienists' Association, 211 E. Chicago Ave., Chicago, Ill. 60611.

Other material on opportunities for dental hygienists is available from:

Division of Dentistry, Public Health Service, U.S. Department of Health, Education, and Welfare, 9000 Rockville Pike, Bethesda, Md. 20014.

The State Board of Dental Examiners in each State, or the National Board of Dental Examiners, 211 E. Chicago Ave., Chicago, Ill. 60611, can supply information on licensing requirements.

DENTAL LABORATORY TECHNICIANS

(D.O.T. 712.381)

Nature of the Work

Dental laboratory technicians make dentures (artificial teeth), fabricate metal or porcelain crowns and inlays to restore teeth, construct bridges of metal and porcelain to replace missing teeth, and also make dental orthodontic appliances. All work is done following written instructions submitted by the dentist, using impressions made by the dentist of a patient's teeth or mouth, from which models are made by dental stone pourings. Sometimes these model pourings are made by the dentist, but most often by the technician.

Trainees in beginning jobs usually mix and pour plaster into casts and molds and perform other simple tasks. As they gain experience, they do more difficult laboratory work. Some dental laboratory technicians do all kinds of laboratory work. Others are specialists who make crowns and bridges, arrange artificial teeth on dental appliances, make plastic molds for dentures, work with dental ceramics (porcelain), or make castings of gold or metal alloys. To perform their work, technicians use small hand instruments such as wax spatulas and wax carvers, as well as special electric lathes and drills, high-heat furnaces, metal-melting torches, and other kinds of specialized laboratory equipment.

Places of Employment

About 42,000 persons worked as dental laboratory technicians in 1976. Most work in commercial laboratories, either as employees or as owners of the business. Commercial laboratories, which handle orders from dentists, usually employ fewer than 10 technicians. However, a few large laboratories employ over 200 technicians.

About 7,000 dental laboratory technicians work in dentists' offices. Others work for hospitals that provide dental services and for the Federal Government, chiefly in Veterans Administration hospitals and clinics and in the Armed Forces. Establishments that manufacture dental materials and equipment also employ technicians as technical or sales representatives.

Dental laboratories are located mainly in large cities and populous States. Many laboratories receive work through the mail from dentists who work a considerable distance away.

Training, Other Qualifications, and Advancement

Although no minimum formal education is needed to enter this occupation, a high school diploma is an asset. Many dental laboratory technicians learn their craft on the job, although more and more are taking formal training programs before starting work. On-the-job training usually lasts 4 or 5 years, depending on the trainee's previous experience, ability to master the techniques, and the number of specialized areas to be learned. A few public vocational high schools offer courses in dental laboratory work that may be taken in conjunction with on-the-job training.

In 1976, 2-year education programs accredited by the American Dental Association (ADA) were offered in 48 schools. High school graduation or equivalent education is required to enter these programs. The first year of training includes formal classroom instruction in dental law and ethics, chemistry, ceramics, metallurgy, and other related subjects. During the second year, the student gets supervised practical experience in the school or dental laboratory. After completion of the 2-year training program, the trainee may need about 3 years more of practical experience to develop the skills needed to be recognized as a well-qualified dental laboratory technician. Those receiving dental laboratory training in the Armed Forces usually qualify for civilian jobs as dental laboratory technicians.

Dental laboratory technicians may become Certified Dental Technicians by passing written and practical examinations given by the National Board for Certification, a trust established by the National Association of

Dental laboratory technicians generally need 4 to 5 years of training.

Dental Laboratories. Certification is becoming increasingly important as evidence of a technician's competence. Well-qualified technicians advance by becoming supervisors or managers in dental laboratories, teachers in dental lab training programs, or salespersons for dental products companies. Some technicians become owners of dental laboratories.

Among the personal qualifications that employers look for in selecting trainees are a high degree of manual dexterity, good color perception, patience, and a liking for detailed work. High school students interested in careers in this occupation are advised to take courses in art, crafts, metal shop, metallurgy, and sciences.

Employment Outlook

Job opportunities for well-qualified dental laboratory technicians are expected to be excellent through the mid-1980's. Some experienced technicians should be able to establish laboratories of their own. A technician whose work has become known to several dentists in a community will have the best prospects of building a successful business.

Employment of dental laboratory technicians is expected to grow faster than the average for all occupations due to expansion of dental prepayment plans and the increasing number of older people who require dentures. In addition, the number of dentists is not expected to keep pace with the demand for their services; to devote more time to treatment of patients, dentists will send more of their laboratory work to commercial firms, or hire technicians to work directly for them.

In addition to job opportunities created by growth, many openings for dental laboratory technicians will occur each year because of the need to replace technicians who die or retire.

Earnings and Working Conditions

Dental laboratory technicians who worked full-time in commercial laboratories received the following average annual salaries in 1976: Trainees

with no experience, $5,600; graduates of 2-year dental technology courses with no experience, $7,600; technicians with no formal training and 2 years of on-the-job experience, $7,300; technicians with 2 to 5 years of experience, regardless of training, $9,400; and technicians with more than 5 years of experience, regardless of training, up to $18,000. Technicians who specialized in ceramics received the highest salaries (up to $25,000). Large dental laboratories employ supervisors or managers who usually earn more than technicians. In general, earnings of self-employed technicians are higher than those of salaried workers.

In the Federal Government, graduates of ADA-approved programs with no experience were paid starting salaries of $8,316 a year in 1977. Experienced dental laboratory technicians employed in the Federal Government generally earned between $11,523 and $16,588 annually, with the average earning $14,000 per year.

Salaried technicians usually work 40 hours a week but selfemployed technicians frequently work longer hours. Many technicians in commercial laboratories receive paid holidays and vacations and some also receive paid sick leave, bonuses, and other fringe benefits. Technicians employed by the Federal Government have the same benefits as other Federal employees.

Sources of Additional Information

For information about training and a list of approved schools contact:

American Dental Association, Council on Dental Education, 211 E. Chicago Ave., Chicago, Ill. 60611.

Information on scholarships is available from dental technology schools or from the American Fund for Dental Health, 211 East Chicago Ave., Chicago, Ill. 60611.

For information on career opportunities in commercial laboratories and requirements for certification, contact:

National Association of Dental Laboratories, 3801 Mt. Vernon Ave., Alexandria, Va. 22305.

Information on careers in the dental technology field also is available from:

Division of Dentistry, Public Health Service, U.S. Department of Health, Education, and Welfare, 9000 Rockville Pike, Bethesda, Md. 20014.

MEDICAL PRACTITIONERS

Medical practitioners work to prevent, cure, and alleviate disease. This group includes almost four times as many physicians as all other practitioners combined.

Physicians, osteopaths, and chiropractors all treat diseases that affect the entire body; chiropractors and osteopaths emphasize manipulation of muscles and bones, especially the spine. Optometrists care for the eyes, and podiatrists treat foot diseases and deformities. Veterinarians treat animals.

All of these occupations are closely regulated. States require that medical practitioners be licensed and pass a State board exam. Only physicians, osteopaths, podiatrists, and veterinarians can use drugs and surgery in their treatment.

Among the six medical practitioner occupations, requirements for a license vary from 6 to 9 years of postsecondary education. After graduation from college, osteopaths must complete a 4-year program and physicians generally 3- or 4-year programs. Most States require a 1-year internship or residency for both physicians and osteopaths. Physicians who specialize must spend more years in residency and pass a specialty board examination. Most schools of chiropractic require that students complete 2 years of college preceding their 4-year program. Optometrists, podiatrists, and veterinarians all must complete a minimum of 2 years of college before beginning the 4-year program.

Although training to become a medical practitioner is more rigorous than that for most other professional occupations, medical practice also offers unusual rewards—financial and otherwise. Medical practitioners earned incomes far in excess of those of all nonsupervisory workers in private industry in 1976, and their earnings exceeded even those of professional workers with similar years of graduate education. In addition to high earnings, medical practitioners also enjoy great prestige within the community. Most also derive considerable personal satisfaction from knowing their work contributes directly to the well being of other people or, in the case of veterinarians, to that of the animal population.

All medical practitioners must have the ability and perseverance to complete the years of study required. Medical practitioners should be emotionally stable, able to make decisions in emergencies, and have a strong desire to help the sick and injured. Sincerity and the ability to gain the confidence of patients also are important qualities for medical practitioners.

CHIROPRACTORS

(D.O.T. 079.108)

Nature of the Work

Chiropractic is a system of treatment based on the principle that a person's health is determined largely by the nervous system, and that interference with this system impairs normal functions and lowers resistance to disease. Chiropractors treat patients primarily by manual manipulation (adjustments) of parts of the body, especially the spinal column.

Because of the emphasis on the spine and its position, most chiropractors use X-rays to aid in locating the source of patients' difficulties. In addition to manipulation, most chiropractors use supplementary measures such as water, light, and heat therapy, and prescribe diet, exercise, and rest. Most State laws specify the types of supplementary treatment permitted in chiropractic. Chiropractors do not use drugs or surgery.

Places of Employment

About 18,000 persons, practiced chiropractic in 1976. Most chiropractors were in private practice.

Chiropractors treat patients primarily by manual manipulation (adjustments) of parts of the body, especially the spinal column.

Some were salaried assistants of established practitioners or worked for chiropractic clinics. Others taught or conducted research at chiropractic colleges.

Chiropractors often locate in small communitees—about half of all active chiropractors work in cities of 50,000 inhabitants or less.

Training, Other Qualifications, and Advancement

All 50 States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. Although the type of practice permitted and the educational requirements for a license vary considerably from one State to another, most States require successful completion of a 4-year chiropractic course following 2 years of preprofessional college work. Some States require that specific subjects such as English, chemistry, biology, or physics be a part of this preprofessional work. In addition, several States require that chiropractors pass a basic science examination. Chiropractors licensed in one State often may obtain a license in other States by reciprocity.

In 1976, there were 13 chiropractic colleges. Four of these institutions were fully accredited by the Council on Chiropractic Education; four others were recognized candidates for accreditation and working toward accreditation. All require a minimum of 2 years of college before entrance, and most colleges require that courses in chemistry and biology be taken during these 2 years. By 1979, the Council on Chiropractic Education will approve only those schools which include courses in English and the social sciences. Chiropractic colleges emphasize courses in manipulation and spinal adjustments. Most offer a broader curriculum however, including subjects such as physiotherapy and nutrition. In most chiropractic colleges, the first 2 years of the curriculum include chiefly classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. During the last 2 years, students obtain practical experience in college clinics. The degree of Doctor of Chiropractic (D.C.) is awarded to students completing 4 years of chiropractic training.

Chiropractic requires a keen sense of observation to detect phyical abnormalities and considerable hand dexterity but not unusual strength or endurance. Persons desiring to become chiropractors should be able to work independently and handle responsibility. The ability to work with detail is important. Sympathy and understanding are among personal qualities considered desirable in dealing effectively with patients.

Most newly licensed chiropractors either set up a new practice or purchase an established one. Some start as salaried chiropractors to acquire experience and funds needed to establish their own practice. A moderate financial investment is usually necessary to open and equip an office.

Employment Outlook

Enrollments in chiropractic colleges have grown dramatically, partly in apparent response to the broader public acceptance of the profession. As more students graduate, new chiropractors may find it increasingly difficult to establish a practice in those areas where other practitioners already are located. The best opportunities for new chiropractors may be in small towns and in areas with comparatively few established practitioners.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low in the beginning. New graduates who worked as associates to established practitioners earned about $12,000 a year in 1976. Experienced chiropractors averaged about $25,000, according to limited data available, although many earn considerably more.

Sources of Additional Information

The State board of licensing in the capital of each State can supply information on State licensing requirements for chiropractors.

General information on chiropractic as a career is available from:

American Chiropractic Association, 2200 Grand Ave., Des Moines, Iowa 50312.

International Chiropractors Association, 741 Brady St., Davenport, Iowa 52808.

For a list of chiropractic colleges, as well as general information on chiropractic as a career, contact:

Council on Chiropractic Education, 3209 Ingersoll Street, Suite 206, Des Moines, Iowa 50312.

For information on requirements for admission to a specific chiropractic college, contact the admissions office of that school.

OPTOMETRISTS

(D.O.T. 079.108)

Nature of the Work

About one out of every two persons in the United States wears corrective lenses. Optometrists provide most of this care. They examine people's eyes for vision problems, disease, and other abnormal conditions, and test for proper depth and color perception and the ability to focus and coordinate the eyes. When necessary, they prescribe lenses and treatment. Where evidence of disease is present, the optometrist refers the patient to the appropriate medical practitioner. Most optometrists supply the prescribed eyeglasses and fit and adjust contact lenses. Optometrists also prescribe corrective eye exercises or other treatment not requiring drugs or surgery.

Although most optometrists are in general practice, some specialize in work with the aged or with children. Others work only with persons having partial sight who can be helped with microscopic or telescopic lenses. Still others are concerned with the visual safety of industrial workers. A few optometrists teach or do research.

Optometrists should not be confused with either ophthalmologists,

About 1 out of every 2 persons in the United States wears corrective lenses.

sometimes referred to as oculists, or with dispensing opticians. Ophthalmologists are physicians who specialize in medical eye care, eye diseases and injuries, perform eye surgery, and prescribe drugs or other eye treatment, as well as lenses. Dispensing opticians fit and adjust eyeglasses according to prescriptions written by ophthalmologists or optometrists; they do not examine eyes or prescribe treatment. (See statement on dispensing opticians.)

Places of Employment

In 1976, there were about 19,700 practicing optometrists. The majority of optometrists are in solo practice. Others are in partnership or group practice with other optometrists or doctors as part of a professional health care team.

Some optometrists work in specialized hospitals and eye clinics or teach in schools of optometry. Others work for the Veterans Administration, public and private health agencies, and industrial health insurance companies. About 500 optometrists serve as commissioned officers in the Armed Forces. Optometrists also act as consultants to engineers specializing in safety or lighting, consultants to educators in remedial reading, or participants on health advisory committees to Federal, State, and local governments.

About two optometrists out of five practice in towns of under 25,000 inhabitants.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require that optometrists be licensed. Applicants for a license must have a Doctor of Optometry degree from an accredited optometric school and pass a State board examination. In some States, applicants are permitted to substitute the National Board of Optometry examination, given in the third and fourth year of optometric school, for part or all of the written State examination. Several States allow applicants to be licensed without lengthy examination if they have a license in another State.

The Doctor of Optometry degree requires a minimum of 6 years of college consisting of a 4-year professional degree program preceded by at least 2 years of preoptometric study at an accredited university, college, or junior college. In 1976, there were 12 schools and colleges of optometry approved by the Council on Optometric Education of the American Optometric Association. One new school was seeking accreditation. Requirements for admission to these schools usually include courses in English, mathematics, physics, chemistry, and biology, or zoology. Some schools also require courses in psychology, social studies, literature, philosophy, and foreign languages. Admission to optometry schools is competitive. Each year, qualified applicants exceed available places, so serious applicants need superior grades in their preoptometric college courses to enhance their chances for acceptance.

Because most optometrists are self-employed, business ability, self-discipline, and the ability to deal with patients tactfully are necessary for success.

Many beginning optometrists enter into associate practice with an optometrist or other health professional. Others purchase an established practice or set up a new practice. Some take salaried positions to obtain experience and the necessary funds to enter their own practice.

Optometrists wishing to advance in a specialized field may study for a Master's or Doctor of Philosophy degree in physiological optics, neurophysiology, public health administration, health information and communication, or health education. Optometrists who enter the Armed Forces as career officers have the opportunity to work toward advanced degrees and to do vision research.

Employment Outlook

Employment opportunities for optometrists are expected to be favorable through the mid-1980's. The number of new graduates from schools of optometry is expected to be adequate to fill the positions made available by employment growth and the need to replace optometrists who die and retire.

Employment of optometrists is expected to grow about as fast as the average for all occupations. An increase in the total population, especially in the group most likely to need glasses—older people—is a major factor contributing to the expected growth in the occupation. Greater recognition of the importance of good vision and the possibility that more persons will have health insurance to cover optometric services, also should increase the demand for optometric services.

Earnings and Working Conditions

In 1976, net earnings of new optometry graduates averaged about $15,500, but some graduates who started work in the optometry department of chain retail stores earned considerably more. Experienced optometrists averaged about $33,000 annually. Optometrists working for the Federal Government earned an average of $19,300 a year in 1977. Incomes vary greatly, depending upon location, specialization, and other factors. However, after several years, optometrists in associateship or partnership practice may earn substantially more than their solo practitioner counterparts.

Independent practitioners can set their own work schedule. Some work over 40 hours a week, including Saturday. Because the work is not physically strenuous, optometrists often can continue to practice after the normal retirement age.

Sources of Additional Information

Information on optometry as a career and a list of scholarships and loan funds offered by various State associations, societies, and institutions are available from:

American Optometric Association, 7000 Chippewa St., St. Louis, Mo. 63119.

Federal Health Professions Loans are available for optometric students who meet certain financial needs requirements. For information on this financial aid, on the availability of Federal scholarships, and on required preoptometry courses, contact individual optometry schools. The Board of Optometry in the capital of each State can supply a list of optometry schools approved by that State, as well as licensing requirements.

OSTEOPATHIC PHYSICIANS

(D.O.T. 071.108)

Nature of the Work

Osteopathic physicians diagnose and treat diseases or maladies of the human body. They are particularly concerned about problems involving the muscles or bones. One of the basic treatments or therapies used by osteopathic physicians centers on manipulating these systems with the hands. Osteopathic physicians also use surgery, drugs, and all other accepted methods of medical care.

Most osteopathic physicians are "family doctors" who engage in general practice. These physicians usually see patients in their offices, make house calls, and treat patients in osteopathic and other private and public hospitals. Some doctors of osteopathy teach, do research, or write and edit scientific books and journals.

In recent years, specialization has increased. In 1976, about 25 percent of all osteopathic physicians were practicing in specialties, including internal medicine, neurology and psychiatry, ophthalmology, pediatrics, anesthesiology, physical medicine and rehabilitation, dermatology, obstetrics and gynecology, pathology, proctology, radiology, and surgery.

Places of Employment

About 15,000 osteopathic physicians practiced in the United States in 1976. Almost 85 percent of the active osteopathic physicians were in private practice. A small number had full-time salaried positions in osteopathic hospitals and colleges, private industry, or government agencies.

Osteopathic physicians are located chiefly in those States that have osteopathic hospital facilities. In 1976, three-fifths of all osteopathic physicians were in Florida, Michigan, Pennsylvania, New Jersey, Ohio, Texas, and Missouri. Twenty-one States and the District of Columbia each had fewer than 50 osteopathic physicians. More than half of all general practitioners are located in towns and cities having fewer than 50,000 people; specialists, however, practice mainly in large cities.

Training and Other Qualifications

All 50 States and the District of Columbia require a license to practice osteopathic medicine. To obtain a license, a candidate must be a graduate of an approved school of osteopathic medicine and pass a State board examination In six States, candidates must pass an examination in the basic sciences before they are eligible to take the professional examination; 37 States and the District of Columbia also require a period of internship in an approved hospital after graduation from an osteopathic school. The National Board of Osteopathic Examiners also gives an examination which is accepted by most States as a substitute for State examination. All States except Alaska and Florida grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

The minimum educational requirement for entry to one of the schools of osteopathic medicine is 3 years of college work, but in practice almost all osteopathic students have a bachelor's degree. Preosteopathic education must include courses in chemistry, physics, biology, and English. Osteopathic colleges require

Osteopathic physicians are particularly concerned about problems involving the muscles or bones.

successful completion of 3 to 4 years of professional study for the degree of Doctor of Osteopathy (D.O.). During the first half of professional training, emphasis is placed on basic sciences, such as anatomy, physiology, and pathology, and on the principles of osteopathy; the remainder of the time is devoted largely to clinical experience with patients in hospitals and clinics.

After graduation, nearly all doctors of osteopathic medicine serve a 12-month internship at 1 of the 79 osteopathic hospitals approved by the American Osteopathic Association for intern and/or residency training. Those who wish to become specialists must have 2 to 5 years of additional training.

The osteopathic physician's training is very costly because of the length of time it takes to earn the D.O. degree. However, Federal and private funds are available for loans for students, and scholarships are available to those who qualify and agree to a minimum of 2 years' Federal service.

In 1977, there were 12 schools of osteopathic medicine. Schools admit students on the basis of grades received in college, scores on the required New Medical College Admissions Test, and recommendations from premedical college counselors. The applicant's desire to serve as an osteopathic physician rather than as a doctor trained in other fields of medicine is a very important qualification. The colleges also give considerable weight to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathic medicine usually establish their own practice, although a growing number are entering group practice. Some work as assistants to experienced physicians or become associated with osteopathic and allopathic (M.D.) hospitals. In view of the variation in State laws, persons who wish to become osteopathic physicians should study carefully the professional and legal requirements of the State in which they plan to practice. The availability of osteopathic hospitals and clinical facilities also should be considered.

Persons who wish to become osteopathic physicians must have a strong desire to pursue this career above all others. They must be willing to study a great deal throughout their career to keep up with the latest advances in osteopathic medicine. They should exhibit leadership, emotional stabiliy, and self-confidence. A pleasant personality, friendliness, patience, and the ability to deal with people also are important.

Employment Outlook

Opportunities for osteopathic physicians are expected to be very good through 1985. Many localities are without medical practitioners of any kind; many more have few or no osteopathic physicians. In addition, many new osteopaths will be needed to replace those who retire or die. The greatest demand probably will continue to be in States where osteopathic medicine is a widely known and accepted method of treatment, such as Pennsylvania, Florida, and a number of Midwestern States. Generally, prospects for beginning a successful practice are likely to be best in rural areas, small towns, and city suburbs, where young doctors of osteopathy may establish their professional reputations more easily than in the centers of large cities.

The osteopathic profession is expected to grow faster than the average for all occupations through the mid-1980's because of population growth, the establishment of additional osteopathic hospital facilities, and the extension of prepayment programs for hospitalization and medical care including Medicare and Medicaid.

Earnings and Working Conditions

In osteopathic medicine, as in many of the other health professions,

incomes usually rise markedly after the first few years of practice. Earnings of individual practitioners are determined mainly by ability, experience, geographic location, and the income level of the community served. In 1974, the average income of general practitioners after business expenses was about $31,000, according to the limited data available. This income is very high in comparison with other professions. Specialists usually had higher incomes than general practitioners.

Many osteopathic physicians work more than 50 or 60 hours a week. Those in general practice work longer and more irregular hours than specialists.

Sources of Additional Information

People who wish to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. Information on Federal scholarships and loans is available from the Director of Student Financial Aid at the individual schools of osteopathy. For a list of State boards, as well as general information on osteopathy as a career, contact:

American Osteopathic Association, Department of Public Relations, 212 East Ohio St., Chicago, Ill. 60611.

American Association of Colleges of Osteopathic Medicine, 4720 Montgomery Lane, Washington, D.C. 20014.

PHYSICIANS

(D.O.T. 070.101 and .108)

Nature of the Work

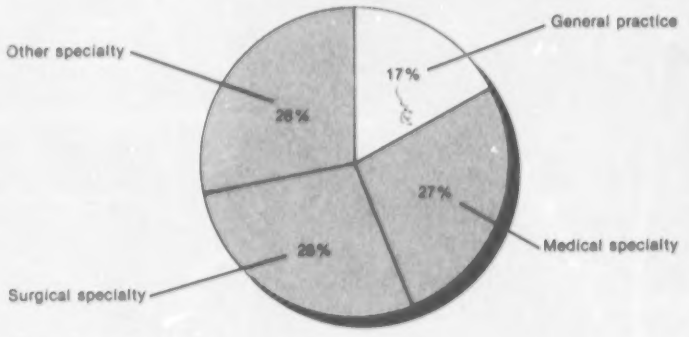
Physicians perform medical examinations, diagnose diseases, and treat people who are suffering from injury or disease. They also try to prevent illness by advising patients on self-care related to diet and exercise. Physicians generally examine and treat patients in their own offices and in hospitals, but they also may visit patients at home.

A decreasing percentage of the physicians who provide patient care are general practitioners (about 15 percent in 1976); most specialize in one of the 34 fields for which there is graduate training. The largest specialties are internal medicine, general surgery, obstetrics and gynecology, psychiatry, pediatrics, radiology, anesthesiology, ophthalmology, pathology, and orthopedic surgery. The most rapidly growing specialty is family practice which emphasizes general medicine.

Some physicians combine the practice of medicine with research or teaching in medical schools. Others hold full-time research or teaching positions or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

Specialists outnumber general practitioners by 5 to 1

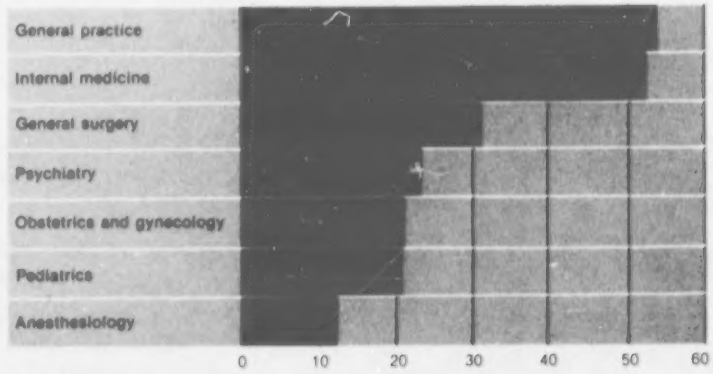
Percent of physicians by specialty group, 1975



Source: American Medical Association

Almost two-thirds of all physicians practice in the seven largest specialties

Number of physicians, 1975 (in thousands)



Source: American Medical Association

Places of Employment

About 360,000 physicians were professionally active in the United States in 1976—almost 9 out of 10 providing patient care services. Nearly 215,000 of these had office practices; more than 94,000 others worked as residents or full-time staff in hospitals. The remaining physicians—about 28,000—taught or performed administrative or research duties.

In 1975, 19,000 graduates of foreign medical schools served as hospital residents in this country. To be appointed to approved residencies in U.S. hospitals, these graduates, except in special instances, must obtain a certificate after passing an examination given by the Educational Commission for Foreign Medical Graduates.

The Northeastern States have the highest ratio of physicians to population and the Southern States the lowest. Because physicians have tended to locate in urban areas, close to hospital and educational centers, many rural areas have been underserved by medical personnel. Currently, more medical students are being exposed to practice in rural communities with the direct support of educational centers and hospitals in more populous areas. In addition, some rural areas offer physicians guaranteed minimum incomes to offset the relatively low earnings typical in rural medical practice.

Competition for entry into medical school is intense even though the number of schools has increased.

Training and Other Qualifications

All States, the District of Columbia, and Puerto Rico require a license to practice medicine. Requirements for licensure include graduation from an accredited medical school, successful completion of a licensing examination, and, in most States, a period of 1 or 2 years in an accredited graduate medical education program (residency). The licensing examination taken by most graduates of U.S. medical schools is the National Board of Medical Examiners (NBME) test. Licensure applicants who have not taken the NBME test must be sponsored by a State in order to sit for the Federation Licensure Examination (FLEX) that is accepted by all jurisdictions. Although physicians licensed in one State usually can get a license to practice in another without further examination, some States limit this reciprocity.

In 1976, there were 116 accredited schools in the United States in which students could begin the study of medicine. Of these, 114 awarded the degree of Doctor of Medicine (M.D.); two schools offered a 2-year program in the basic medical sciences to students who could then transfer to regular medical schools for the last semesters of study.

The minimum educational requirement for entry to a medical school is 3 years of college; some schools require 4 years. A few medical schools allow selected students who have exceptional qualifications to begin their professional study after 2 years of college. Most students who enter medical schools have a bachelor's degree.

Required premedical study includes undergraduate work in English, physics, biology, and inorganic and organic chemistry. Students should take courses in the humanities, mathematics, and the social sciences to acquire a broad general education.

Medicine is a popular field of study, and competition for entry to

medical school is intense. In 1976, there were about 42,000 applicants for only 15,613 positions. Almost all of those accepted had premedical college grades averaging 'B' or better. Other factors considered by medical schools in admitting students include their scores on the New Medical College Admission Test, which is taken by almost all applicants. Consideration also is given to the applicant's character, personality, and leadership qualities, as shown by personal interviews, letters of recommendation, and extracurricular activities in college. Many State-supported medical schools give preference to residents of their particular States and, sometimes, those of nearby States.

Most medical students take 4 years to complete the curriculum for the M.D. degree. Many schools, however, allow students who have demonstrated outstanding ability to follow a shortened curriculum, generally lasting 3 years. A few schools offer the M.D. degree within 6 years of high school graduation.

The first semesters of medical school training are spent primarily in laboratories and classrooms, learning basic medical sciences such as anatomy, biochemistry, physiology, pharamacology, microbiology, and pathology. Additionally, many schools are integrating some clinical experience with patients into the first 2 years of study. During the last semesters, students spend the majority of their time in hospitals and clinics under the supervision of experienced physicians. They learn to take case histories, perform examinations, and recognize diseases.

After graduating from medical school, almost all M.D.'s serve a 1- or 2-year residency. Those planning to work in general practice often spend an additional year in a hospital residency. Those seeking certification in a specialty spend from 2 to 4 years—depending on the specialty—in advanced residency training, followed by 2 years of practice or more in the specialty. Then they must pass the specialty board examinations. Some physicians who want to teach or do research take graduate work leading to a master's or Ph. D. degree in a field such as biochemistry or microbiology.

Medical training is very costly because of the long time required to earn the medical degree. However, financial assistance in the form of loans and scholarships is available primarily from the Federal Government, and to a lesser extent from State and local government and private sources. Some of this aid requires the student to commit a minimum of 2 years' time to Federal service upon graduation and/or to establish financial need.

Persons who wish to become physicians must have a strong desire to serve the sick and injured. They must be willing to study a great deal to keep up with the latest advances in medical science. Sincerity and a pleasant personality are assets that help physicians gain the confidence of patients. Prospective physicians should be emotionally stable and able to make decisions in emergencies.

The majority of newly qualified physicians open their own offices or join associate or group practices. Those who have completed 1 year of graduate medical education (a 1-year residency) and enter active military duty initially serve as captains in the Army or Air Force or as lieutenants in the Navy. Graduates of medical schools are eligible for commissions as senior assistant surgeons (equivalent to lieutenants in the Navy) in the U.S. Public Health Service, as well as for Federal Civil Service professional medical positions.

Employment Outlook

The employment outlook for physicians is expected to be very good through the mid-1980's. However, anticipated increases in the numbers of graduates of existing and developing U.S. medical schools, combined with foreign medical graduate entrants, point to a greatly improved supply situation. This may result in an increasing movement of physicians into rural and other areas that have experienced shortages in the past. Also, some specialties will have sufficient numbers of practitioners by 1980 or 1985 so that new graduates will be encouraged to specialize in one of the primary care areas such as family practice, pediatrics, or internal medicine.

Growth in population will create much of the need for more physicians, and a larger percentage of the population will be in the age group over 65, which uses more physicians' services. Also, the effective demand for physicians' care will increase because of greater ability to pay, resulting from extension of prepayment programs for hospitalization and medical care, including Medicare and Medicaid, and continued Federal Government provision of medical care for members of the Armed Forces, their families, and veterans. More physicians will be needed, in addition, for medical research, teaching in medical schools, and the continuing growth in the fields of public health, rehabilitation, industrial medicine, and mental health.

To some extent, the rise in the demand for physicians' services will be offset by developments that will enable physicians to care for more patients. For example, increasing numbers of medical technicians are assisting physicians; new drugs and new medical techniques are shortening illnesses; and growing numbers of physicians are using their time more effectively by engaging in group practice.

The extent to which the developing health occupations, such as those of physicians' assistants and nurse practitioners, will enable each physician to treat more patients is still unknown. It is possible that these new health personnel will increase physicians' productivity significantly.

The net effect of expected growth in requirements for physicians and of increases in their number and productivity is likely to be an improved availability of medical care. New physicians will have little difficulty establishing practices, however. Even in the unlikely event that some urban areas become overserved and need no additional doctors, many remote and rural areas are without M.D.'s. If some proposed incentives are implemented, physicians may be able to practice in these underserved areas without forfeiting access to consultation with specialists and

without earning an income significantly below that of most colleagues located in cities.

Earnings and Working Conditions

Salaries of medical school graduates serving as residents in hospitals vary according to the type of residency, geographic area, and size of hospital, but earnings of $12,000 to $13,000 a year are common. Many hospitals also provide full or partial room, board, and other maintenance allowances to their residents.

Graduates who have completed an approved 3-year residency but have no other experience could expect to start working at a Veterans Administration hospital for an annual salary of between $27,000 and $31,500 a year in 1977. In addition, those who work full time could expect another $5,500 to $5,800 in other cash benefits or "special" payments.

Newly qualified physicians who establish their own practice must make a sizable financial investment to equip a modern office. During the first year or two of independent practice, physicians probably earn little more than the minimum needed to pay expenses. As a rule, however, their earnings rise rapidly as their practice develops.

Physicians have the highest average annual earnings of any occupational group. The net income of physicians who provided patient care services averaged almost $54,000 in 1976, according to the limited information available. Earnings of physicians depend on factors such as the region of the country in which they practice; the patients' income levels; and the physician's skill, personality, and professional reputation, as well as the length of experience. Self-employed physicians usually earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners. Many physicians have long working days and irregular hours. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they may accept fewer new patients and tend to work shorter hours. However, many continue in practice well beyond 70 years of age.

Sources of Additional Information

Persons who wish to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Information on Federal scholarships and loans is available from the director of student financial aid at the individual medical schools. For a list of approved medical schools, as well as general information on premedical education, financial aid, and medicine as a career, contact:

Council on Medical Education, American Medical Association, 535 N. Dearborn St., Chicago, Ill. 60610.

Association of American Medical Colleges, Suite 200, One Dupont Circle, NW., Washington, D.C. 20036.

PODIATRISTS

(D.O.T. 079.108)

Nature of the Work

Podiatrists diagnose and treat foot diseases and deformities. They perform surgery, fit corrective devices, and prescribe drugs, physical therapy, and proper shoes. To help in diagnoses, they take X-rays and perform or prescribe blood and other pathological tests. Among the conditions podiatrists treat are corns, bunions, calluses, ingrown toenails, skin and nail diseases, deformed toes, and arch disabilities. They refer patients to medical doctors whenever the feet show symptoms of medical disorders affecting other parts of the body—such as arthritis, diabetes, or heart disease—while continuing to treat for the foot problem.

Some podiatrists specialize in foot surgery, orthopedics (bone, muscle, and joint disorders), podopediatrics (children's foot ailments), or podogeriatrics (foot problems of the elderly). However, most provide all types of foot care.

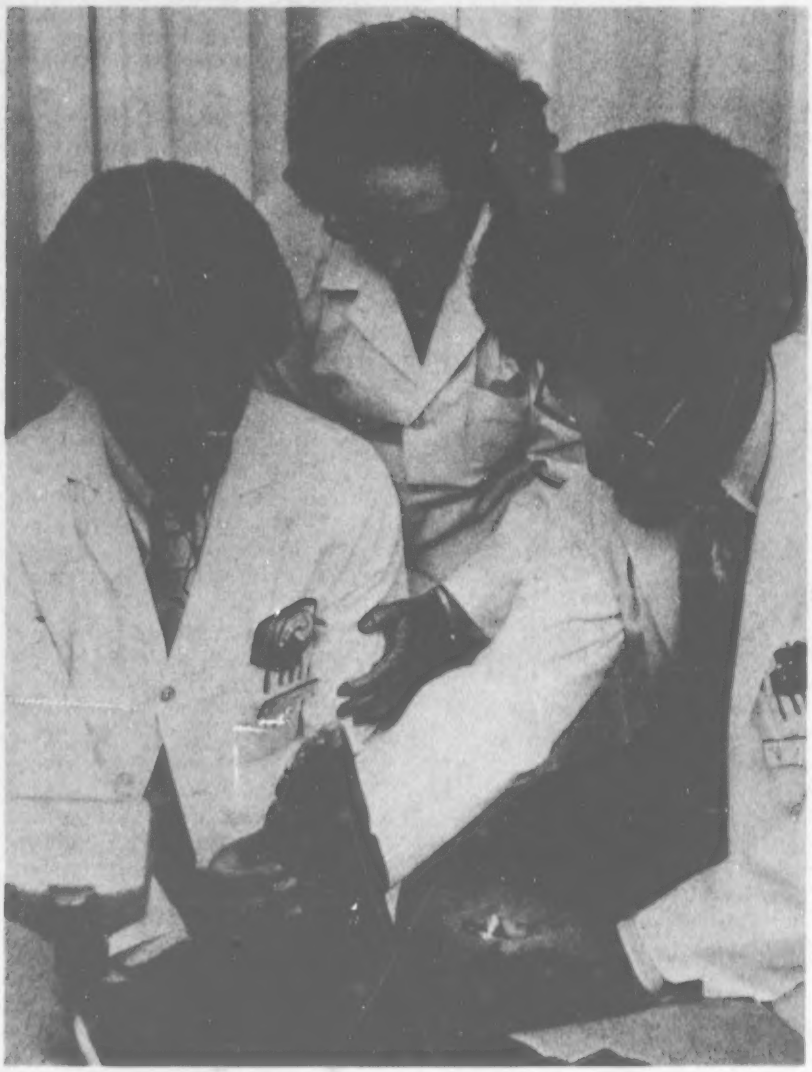
Places of Employment

About 7,500 persons practiced podiatry in 1976, most of them located in large cities. Those who had full-time salaried positions worked mainly in hospitals, podiatric medical colleges, or for other podiatrists. The Veterans Administration and public health departments employ podiatrists on either a full- or part-time basis. Others serve as commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license for the practice of podiatry. To qualify for a license, an applicant must graduate from an accredited college of podiatric medicine and pass a written and oral State board proficiency examination. Four States—Georgia, Michigan, New Jersey, and Rhode Island—also require applicants to serve a 1-year residency in a hospital or clinic after graduation. Three-fourths of the States grant licenses without further examination to podiatrists licensed by another State.

Minimum entrance requirements at the colleges of podiatric medicine include 3 years of college work with courses in English, chemistry, biology or zoology, physics, and mathematics. Most entrants to podiatry schools have completed at least 3 years of college. Competition for entry to these schools is strong, however, and most entrants surpass the minimum requirements. More than 90 percent of the entering class of 1976 held at least a bachelor's degree, and the average enrollee had an overall grade point average of 'B' or better. All colleges of podiatric medicine require applicants to take the New Medical College Admissions Test. Of the 4 years in podiatry school, the first 2 are spent in classroom instruction and laboratory work in anatomy, bacteriology, chemistry, pathology, physiology, pharmacology, and other basic sciences. During the final 2 years, students obtain clinical experience



Podiatrists diagnose and treat foot problems.

while continuing their academic studies. The degree of Doctor of Podiatric Medicine (D.P.M.) is awarded upon graduation. Additional education and experience generally are necessary to practice in a specialty. Federal, State, and private loans are available for needy students to pursue full-time study leading to a degree in podiatric medicine.

Persons planning a career in podiatry should have scientific aptitude and manual dexterity, and like detailed work. A good business sense and congeniality also are assets in the profession.

Most newly licensed podiatrists set up their own practices. Some purchase established practices, or obtain salaried positions to gain the experience and money needed to begin their own.

Employment Outlook

Opportunities for graduates to establish new practices, as well as to enter salaried positions, should be favorable through the mid-1980's.

Employment of podiatrists is expected to grow about as fast as the average for all occupations as an expanding population demands more health services. The growing number of older people who need foot care and those who are entitled to certain podiatrists' services under Medicare, also is expected to spur demand for podiatric services. More podiatrists will be needed to work in hospitals, extended care facilities, and public health programs.

Earnings and Working Conditions

Newly licensed podiatrists build their practices over a number of years. Income during the first several years will be less than in later years. The average income of all podiatrists, after expenses but before taxes, was over $42,000 in 1976, according to the limited information available.

The workweek of podiatrists is generally 40 hours, and they may set their hours to suit their practice.

Sources of Additional Information

Information on license requirements in a particular State is available from that State's board of examiners in the State capital.

Information on colleges of podiatric medicine, entrance requirements, curriculums, and student financial aid is available from:

American Association of Colleges of Podiatric Medicine, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

For additional information on podiatry as a career, contact:

American Podiatry Association, 20 Chevy Chase Circle, NW., Washington, D.C. 20015.

VETERINARIANS

(D.O.T. 073.081 through .281)

Nature of the Work

Veterinarians (doctors of veterinary medicine) diagnose, treat, and control diseases and injuries among

Over one-third of all veterinarians treat small animals or pets exclusively.

animals. They help prevent the outbreak and spread of animal diseases, many of which can be transmitted to human beings.

Veterinarians treat animals in hospitals and clinics or on farms and ranches. They perform surgery on sick and injured animals and prescribe and administer drugs, medicines, and vaccines.

Veterinary medicine offers a variety of practice specialties. Over one-third of all veterinarians treat small animals or pets exclusively. About another third treat both large and small animals. A large number specialize in the health and breeding of cattle, poultry, sheep, swine, or horses. Many veterinarians inspect meat, poultry, and other foods as part of Federal and State public health programs. Still others teach in veterinary colleges, do research related to animal diseases, foods, and drugs, or work as part of a medical research team to learn about prevention and treatment of human disease.

Places of Employment

There were about 30,500 veterinarians active in 1976—most in private practice. The Federal Government employed about 2,300 veterinarians, chiefly in the U.S. Department of Agriculture and the U.S. Public Health Service. About 750 more were commissioned officers in the veterinary services of the Army and Air Force. Other employers of veterinarians are State and local government agencies, international health agencies, colleges of veterinary medicine, medical schools, research and development laboratories, large livestock farms, animal food companies, and pharmaceutical companies that manufacture drugs for animals.

Veterinarians are located in all parts of the country, and the type of practice generally varies according to geographic setting. Veterinarians in rural areas mainly treat farm animals; those in small towns usually engage in general practice; those in cities and suburban areas often limit their practice to pets.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require veterinarians to have a license. To obtain a license, applicants must have a Doctor of Veterinary Medicine (D.V.M. or V.M.D.) degree from an accredited college of veterinary medicine and pass written and oral State board proficiency examinations. Some States issue licenses without further examination to veterinarians already licensed by another State.

For positions in research and teaching, an additional master's or Ph. D. degree usually is required in a field such as pathology, physiology, or bacteriology.

The D.V.M. or V.M.D. degree requires a minimum of 6 years of college consisting of a 4-year professional degree program, preceded by at least 2 years of preveterinary study that emphasizes the physical and biological sciences. Two veterinary medical colleges require 3 years of preventerinary work, however, and most applicants have completed 3 to 4 years of college before entering the professional programs. In addition to rigorous academic instruction, professional training includes considerable practical experience in diagnosing and treating animal diseases and performing surgery and laboratory work in anatomy, biochemistry, and other scientific and medical subjects.

In 1976, there were 21 colleges of veterinary medicine accredited by the Council on Education of the American Veterinary Medical Association. Admission to these schools is highly competitive. Each year there are many more qualified applicants than the schools can accept. Serious applicants usually need grades of "B" or better, especially in science courses. Experience in part-time or summer jobs working with animals is advantageous. Colleges usually give preference to residents of the State in which the college is located, because these schools are largely State supported. In the South and West, regional educational plans permit cooperating States without veterinary schools to send students to designated regional schools. In other areas, colleges that accept a certain number of students from other States usually give priority to applicants from nearby States that do not have veterinary schools.

Federal funds provide a limited number of loans for needy students who want to pursue full-time study leading to the degree of Doctor of Veterinary Medicine.

Most veterinarians begin as employees or partners in established practices. A few start their own practices with a modest financial investment in drugs, instruments, and an automobile. With a more substantial investment, one may open an animal hospital or purchase an established practice.

Newly qualified veterinarians may enter the Army and Air Force as commissioned officers, or qualify for Federal positions as meat and poultry inspectors, disease-control workers, epidemiologists, research assistants, or commissioned officers in the U.S. Public Health Service. A license is not required for Federal employment.

Employment Outlook

Employment opportunities for veterinarians are expected to be favorable through the mid-1980's. Veterinary employment is expected to grow faster than the average for all occupations during this period, primarily because of growth in the companion animal (horses, dogs, and other pets) population and an increase in veterinary research. Emphasis on scientific methods of raising and breeding livestock and poultry and growth in public health and disease control programs also will contribute to the demand for veterinarians.

Earnings and Working Conditions

Newly graduated veterinarians employed by the Federal Government started at $16,000 a year in 1977. The average annual salary of veterinarians in the Federal Government was $24,300. The incomes of veterinarians in private practice vary considerably, depending on factors such as location, type of practice, and years of experience, but usually are higher than those of other veterinarians, according to the limited data available.

Veterinarians sometimes may be exposed to danger of injury, disease, and infection. Those in private practice often have long and irregular working hours. Veterinarians in rural areas may have to spend much time traveling to and from farms and may have to work outdoors in all kinds of weather. Because they are self-employed, veterinarians in private practice usually can continue working well beyond normal retirement age.

Sources of Additional Information

A pamphlet entitled *Today's Veterinarian* presents additional information on veterinary medicine as a career, as well as a list of colleges of veterinary medicine. A free copy may be obtained by submitting a request, together with a self-addressed stamped business size envelope, to:

American Veterinary Medical Association, 930 N. Meacham Rd., Schaumburg, Ill. 60196.

Information on opportunities for veterinarians in the U.S. Department of Agriculture is available from:

Agricultural Research Service, U.S. Department of Agriculture, Hyattsville, Md. 20782.

Animal and Plant Health Inspection Service, Personnel Division, 12th and Independence Ave. SW., Washington, D.C. 20250.

Agricultural Marketing Service, Personnel Division, 12th and Independence Ave. SW., Washington, D.C. 20250.

Students seeking loan or scholarship assistance should send inquiries to the schools in which they are interested.

MEDICAL TECHNOLOGIST, TECHNICIAN, AND ASSISTANT OCCUPATIONS

This section deals in detail with nine health occupations that are technical or clerical in nature. Many of these occupations were developed to relieve highly trained professionals of their less complicated and routine duties: *Optometric assistants*, for example, give preliminary eye examinations and help patients do prescribed eye exercises to free optometrists and ophthalmologists for more demanding professional duties.

Other medical technician jobs have emerged to meet a previously unfilled need for medical care in situations where physicians and registered nurses are unavailable. Emergency medical technicians, for example, provide medical attention at the site of a fire or an automobile accident.

The development of sophisticated diagnostic tools and techniques for treatment, brought about by advances in medical science and technology, also has created the need for workers such as *electrocardiograph technicians* who operate equipment that monitors a patient's heart action, and *electroencephalographic technicians* who operate equipment that monitors the electrical activity of a patient's brain.

Medical record technicians and clerks process the large numbers of medical records generated daily in hospitals and nursing homes.

ELECTROCARDIOGRAPH TECHNICIANS

(D.O.T. 078.368)

Nature of the Work

Electrocardiograms (EKG's) are graphic heartbeat tracings produced by an instrument called an electrocardiograph. These tracings record the electrical changes that occur during a heartbeat. Physicians use electrocardiograms to diagnose irregularities in heart action and to analyze changes in the condition of a patient's heart over a period of time. Some physicians order electrocardiograms as a routine diagnostic procedure for persons who have reached a specified age. Electrocardiograms are required as part of pre-employment physical examinations for people in many fields. In some cases, the tests also are used if surgery is to be performed.

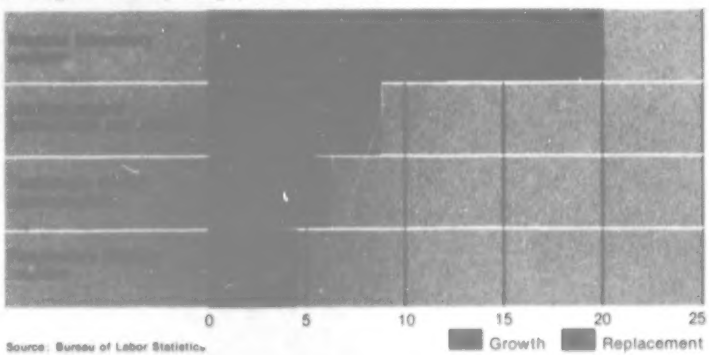
At the request of a physician, electrocardiograms can be recorded in a doctor's office, in the EKG department of a hospital, or at the patient's bedside, since the equipment is mobile. The technician straps electrodes to specified parts of the patient's body, manipulates switches of the electrocardiograph, and moves electrodes across the patient's chest. The technician must know the anatomy of the chest and heart to properly select the exact locations for the chest electrodes, since the wrong selection yields an inaccurate diagnosis. The test may be given while the patient is at rest, or before and after mild exercise.

The electrocardiograph records the "picture" of the patient's heart action on a continuous roll of paper. The technician then clips and mounts this electrocardiogram for analysis by a physician, usually a heart specialist. Technicians must recognize and correct any technical errors in the machine such as crossed wires or electrical interference, that prevent an accurate reading. They also must call the doctor's attention to any significant deviations from the norm.

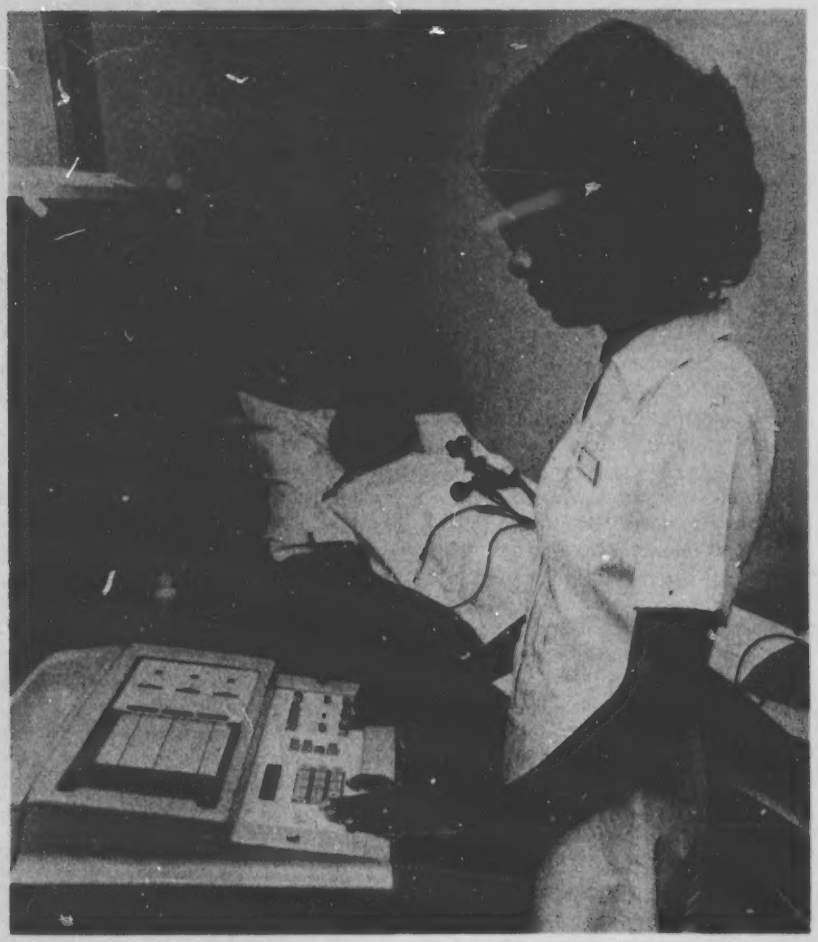
EKG technicians sometimes conduct other tests such as vectorcardiograms, which are three-dimensional traces, phonocardiograms, which record the sounds of the heart valves and blood passing through them, stress testing (exercise tests), pulse readings, and Holter monitoring and scanning, which is a 12- to 24-hour recording of electrocardiography. Some technicians do echocardiography, which utilizes very high frequen-

Despite a large number of openings in many health technician occupations, competition will exist due to the large supply of qualified job seekers

Selected medical technologist, technician, and assistant occupations
Average annual openings, 1976-85 (in thousands)



Source: Bureau of Labor Statistics



The electrocardiograph records the "picture" of the patient's heart action.

cy sound waves—"ultra sound"—to detect heart problems, such as congenital defects. In addition, technicians usually schedule appointments, type doctors' diagnoses, maintain patients' EKG files, and care for equipment.

Places of Employment

Nearly 12,000 persons worked as electrocardiograph technicians in 1976. Most EKG technicians worked in cardiology departments of large hospitals. Others worked part time in small general hospitals where workloads are usually not great enough to demand full-time technicians. Some worked full or part time in clinics and doctors' offices.

Training, Other Qualifications, and Advancement

Generally, EKG technicians are trained on the job. Training—usually conducted by an EKG supervisor or a cardiologist—lasts from 3 to 6 months for the basic EKG tests and up to 1 year for the more complex ones. Vocational schools in several states and junior colleges give college credit for cardiology technology courses, and some colleges have added cardiology technology to their curricula. Generally, the minimum educational requirement for the job is high school graduation. Among high school courses that are recommended for students interested in this field are health, biology, and typing. Familiarity with medical terminology also is helpful and can be acquired in classes on human anatomy and physiology and by studying a medical dictionary.

Persons who want to become EKG technicians should have mechanical aptitude, the ability to follow detailed instructions, presence of mind in emergencies, reliability, and patience.

Though opportunities for advancement generally are limited, large hospitals sometimes promote EKG technicians to supervisors. Advancement to cardiovascular technician, cardiopulmonary technician, and cardiology technologist also is possible.

Employment Outlook

The employment of EKG technicians is expected to grow faster than the average for all occupations because of increasing reliance on electrocardiographs to diagnose heart diseases and for physical examinations of older patients. Also contributing to the expected growth of this occupation is the increased demand for health services in general, as a result of greater health consciousness, new medical techniques and drugs, and extension of prepayment programs that make it easier for people to pay for health and medical care.

In addition to openings from growth, workers will be needed to replace technicians who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

EKG technicians in hospitals and medical centers earned starting salaries of about $6,900 a year in 1976, according to a survey conducted by the University of Texas Medical Branch. Experienced EKG technicians, in some cases, earned as much as $13,700 a year.

Inexperienced EKG technicians with the Federal Government earned $6,572 a year in 1977; a few experienced technicians earned as much as $12,093 a year. Usually, EKG technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

In general, those EKG technician with previous formal training earn higher starting salaries than those who learn on the job.

EKG technicians in hospitals receive the same fringe benefits as other hospital personnel, including hospitalization, vacation, and sick leave benefits. Some institutions provide tuition assistance or free education courses, pension programs, and uniforms. Technicians generally work a 40-hour week, which may include Saturdays and Sundays.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. For additional information about the work of EKG technicians, contact:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

Miss Ruth Jackson, President, American Cardiology Technologists Association, Scott and White Clinic, Temple, Tex. 76501.

ELECTRO-ENCEPHALOGRAPHIC TECHNOLOGISTS AND TECHNICIANS

(D.O.T. 078.368)

Nature of the Work

The field of electroencephalography (EEG) is concerned with recording and studying the electrical activity of the brain. A special instrument, the electroencephalograph, records this activity, producing a written tracing of the brain's electrical impulses. This record of brain waves is called an electroencephalogram.

Various kinds of brain disease can be diagnosed by neurologists and other qualified medical practitioners with the use of EEG. Electroencephalograms are taken for patients suspected of having brain tumors, strokes, or epilepsy. The consequences of infectious diseases on the brain can be measured with EEG. Electroencephalograms may be taken of children with serious adjustment problems or learning difficulties to discover any organic basis for these problems. EEG also may be used prior to vital organ transplant operations, to help determine whether the potential donor is dead or alive.

The people who operate EEG machinery are known as EEG technicians and technologists. The main job of an EEG technician is to produce electroencephalograms, under the supervision of an EEG technologist or an electroencephalographer (a physician specializing in electroencephalography). Before doing this job, the technician takes a simplified medical history of the patient and helps the patient relax for the test. The technician then applies the electrodes of the electroencephalograph to designated spots on the patient's head and makes sure that the machine is working well. The technician chooses the most appropriate combinations of instrument controls and electrodes to produce the kind of record needed. EEG technicians must be able to recognize and correct any artifacts that appear (an artifact is an electrical or mechanical event that comes from somewhere other than the brain). If there are any mechanical problems with the electroencephalograph, the technician must advise his or her supervisor, so that the machine can be repaired promptly. EEG technicians also need a basic understanding of the kinds of medical emergencies that can occur in laboratories, to be able to react properly if an emergency arises. For example, if a patient suffers an epileptic seizure, the EEG technician must take the proper action.

EEG technologists usually perform all the duties of EEG technicians, but have a more thorough understanding of all aspects of EEG work. Thus they can apply specific EEG techniques to the particular requirements of a patient. Technologists also may use EEG equipment in conjunction with other electrophysiologic monitoring devices, such as a tape recorder. They also can repair the equipment if it is not working properly. After producing an EEG recording, the technologist writes a descriptive report to accompany it for use by electroencephalographers.

Part of an EEG technologist's job is to supervise EEG technicians. Besides direct supervision during EEG recordings, this includes such things as arranging work schedules and teaching EEG techniques. Technologists often have administrative responsibilities, such as managing the laboratory, keeping records, scheduling appointments, and ordering supplies.

The electroencephalograph records the electrical activity of the brain.

Places of Employment

About 4,300 persons worked as electroencephalographic technologists and technicians in 1976. Although EEG personnel work primarily in the neurology departments of hospitals, many work in private offices of neurologists and neurosurgeons.

Training, Other Qualifications, and Advancement

Most EEG technicians working in 1976 were trained on the job by experienced EEG personnel. However, with advances in medical technology, electroencephalograph equipment has become increasingly more sophisticated, requiring technicians with more training.

The Council on Medical Education of the American Medical Association, in collaboration with the American Electroencephalographic Society, the American Medical Electroencephalographic Association, and the American Society of Electroencephalographic Technologists, has developed standards for educational programs to train EEG technologists and technicians. These standards recommend that programs last from 1 to 2 years and include laboratory experience as well as classroom instruction in neurology, anatomy, neuroanatomy, physiology, neurophysiology, clinical and internal medicine, psychiatry, and electronics and instrumentation. Programs may be carried on in colleges, junior colleges, medical schools, hospitals, and vocational or technical schools. There were nine AMA-approved training programs for EEG technologists and technicians in 1976.

EEG personnel who have 1 year of training and 1 year of laboratory experience, and who successfully complete a written and oral examination administered by the American Board of Registration of Electroencephalograph Technologists (ABRET), are designated "Registered EEG Technologist" (R.EEG.T.). Although not a general requirement for employment, registration by ABRET is acknowledgment of a technologist's qualifications, and makes better paying jobs easier to obtain.

Persons who want to enter this field should have manual dexterity, good vision, an aptitude for working with electronic equipment, and the ability to work with patients as well as with other members of the hospital team. High school students considering a career in this occupation should take courses in health, biology, and electronics.

Some EEG technicians in large hospitals advance to chief EEG technologist and have increased responsibilities in laboratory management and in teaching basic techniques to new personnel. Chief EEG technologists are supervised by an electroencephalographer, or a neurologist or neurosurgeon.

Employment Outlook

The employment of EEG technologists and technicians is expected to grow faster than the average for all occupations due to the increased use of EEG's in surgery and in diagnosing and monitoring patients with brain disease. Contributing to the overall increase in health services and the need for EEG technologists and technicians are greater health consciousness and more prepaid health programs. Registered EEG Technologists will have the best employment opportunities.

In addition to openings from growth, many openings will arise when workers retire or leave the field for other reasons.

Earnings and Working Conditions

Starting salaries of EEG technicians employed by hospitals and medical centers averaged $7,800 a year in 1976, according to a survey by the University of Texas Medical Branch. Starting salaries for Registered EEG Technologists were $1,000 to $2,000 higher. Top salaries of experienced EEG technicians ranged as high as $20,600 a year. Highly qualified technologists may earn more as teachers in special training situations or as supervisors of EEG laboratories.

Inexperienced EEG trainees employed by the Federal Government received $6,572 a year in 1977 but they could advance to as much as $11,047 a year. Usually, EEG technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

EEG technologists and technicians in hospitals receive the same benefits as other hospital personnel, including hospitalization, vacation, and sick leave benefits. Some institutions may provide tuition assistance or free courses, pension programs, uniforms, and parking.

EEG technologists and technicians generally work a 40-hour week with little overtime, although some hospitals require a standby emergency service after hours and on weekends and holidays.

Sources of Additional Information

Local hospitals can supply information about employment opportunities. Additional information is available from:

American Hospital Association, 840 North Lake Shore Dr., Chicago, Ill. 60611.

For general information about a career in the field of electroencephalography as well as information on registration with ABRET, contact:

Ms. Sandra Clenney, R. EEG T., EEG 005, Upham Hall, O.S.U. Hospital, Columbus, Ohio 43210.

EMERGENCY MEDICAL TECHNICIANS

(D.O.T. 354.374)

Nature of the Work

An automobile accident, a heart attack, a near drowning, an unscheduled childbirth, a poisoning, a gunshot wound—all of these situations demand urgent medical attention. Seeing medical emergencies like these handled on television has made millions of Americans aware of the crucial role played by emergency

medical technicians (EMT's), sometimes called ambulance attendants.

A call from a dispatcher sends EMT's—who usually work in teams of two—to the scene of the emergency. Although speed is essential, the EMT's obey the traffic laws for the operation of emergency vehicles. They also must know the best route to take in the face of traffic, road construction, and weather conditions.

Upon arriving at the scene of the emergency, the driver parks the ambulance in a safe place to avoid accidents. If no police are present, bystanders may be enlisted to lend a hand. For instance, in the case of an automobile accident, bystanders can help control traffic by placing road flares, removing debris, and redirecting traffic.

EMT's first determine the nature and extent of the victims' illnesses or injuries and establish priorities for emergency medical care. Patients receive appropriate medical care, such as opening and maintaining an airway, restoring breathing, controlling bleeding, treating for shock, immobilizing fractures, bandaging, assisting in childbirth, managing mentally disturbed patients, and giving initial care to poison and burn victims.

EMT training stresses efficiency and confidence to reassure both patients and bystanders. EMT's try to handle patients correctly—not wasting any time nor working too hastily. When the situation requires, as in the case of possible epilepsy or diabetes, EMT's look for medical identification emblems that are clues to providing correct treatment.

When persons are trapped, such as in an automobile accident, EMT's face a double problem. First they must assess the victims' injuries and supply all possible emergency medical care and protection to the trapped persons. Then they must use the correct equipment and techniques to remove the victims safely. EMT's may request additional help or special rescue or utility services by radio or telephone from a dispatcher.

In case of death, EMT's notify the proper authorities and arrange for the protection of the deceased's property.

Often patients must be transported to a hospital. In such instances, EMT's place the patients on stretchers, lift them into the ambulance, and secure both the patients and the stretchers for the ride. EMT's choose the nearest hospital they consider best equipped and staffed to treat their patients. To assure prompt treatment upon arrival, EMT's report by radio directly to the hospital emergency department or the emergency dispatcher about the nature and extent of injuries or illness, the number of persons being transported, and the destination. They may ask for additional advice from the hospital's emergency medical staff.

On the way to the emergency department, EMT's constantly watch the patients to give additional care as needed or as directed by a physician with whom they have radio contact.

Upon arrival at the hospital, they help transfer the patients from the ambulance to the emergency department. They report their observations and care of the patients to the emergency department staff for diagnostic purposes and as a matter of record. If called upon, EMT's help the emergency department staff.

One of the duties of EMT's is to maintain a clean, well-equipped ambulance. After each run, EMT's replace the used linen, blankets, and other supplies, send the used items to be sterilized, and carefully check all equipment so that the ambulance is ready for the next trip. If they have carried patients who have contagious infection or have been exposed to radiation, they decontaminate the interior of the ambulance and report such calls to the proper authorities. EMT's make sure that the ambulance is in good operating condition by checking the gasoline, oil, tire pressure, lights, siren, heater, and communications equipment before their shift begins.

In addition to the basic EMT, whose work has been described, there are two other types of EMT's: EMT-Paramedics and EMT-Dispatchers. Working with radio communication under the direction of a physician, EMT-Paramedics may administer drugs, both orally and intravenously, and use more complex equipment, such as a defibrillator, than basic EMT's.

Although not dealing directly with emergency patients, EMT-Dispatchers nevertheless play an important role. They receive and process calls for emergency medical assistance. Dispatchers send the appropriate persons and resources to the emergency site and coordinate the movement of emergency medical vehicles from start to finish. By means of telephone and radio, dispatchers serve as a communications link between the appropriate medical facility and those who are sent to attend the emergency patients. EMT-Dispatchers also handle communications for public safety agencies, such as police and fire departments so that services like traffic and fire control can be performed.

Places of Employment

In 1976, an estimated 287,000 persons worked as EMT's. About half were volunteers on rescue squads, most of whom work closely with fire departments.

Many paid EMT's work for police and fire departments and private ambulance companies. Funeral homes providing ambulance service employ some EMT's, although in recent years many funeral homes have left this field. A few EMT's work on hospital-based ambulance squads.

Training, Other Qualifications, and Advancement

Few EMT's received formal training until recent years. Now instruction in emergency medical care techniques is mandatory. A standard training course is the 81-hour program designed by the U.S. Department of Transportation. This program, or its equivalent, is available in all 50 States and the District of Columbia. It is offered by police, fire, and health departments, in hospitals, and as a special course in medical schools, colleges, and universities.

This course provides instruction and practice in dealing with emergencies such as bleeding, fractures,

airway obstruction, cardiac arrest, and emergency childbirth. Students learn to use and care for common emergency equipment, such as backboards, suction machines, fracture kits, oxygen delivery systems, and stretchers. Physicians and nurses usually give the lectures and demonstrations.

After completing the basic 81-hour program, students may take a 2-day course dealing with the removal of trapped victims. Further training courses presently are being prepared by the Department of Transportation for the categories of EMT-Paramedic and EMT-Dispatcher. A special course on driving also is in preparation. Thus, a career ladder for the EMT field is being established.

Admittance to an EMT training course requires that the applicant be at least 18 years old, have a high school diploma or the equivalent, and have a valid driver's license. Among high school subjects recommended for persons interested in the field are driver education and health and science courses. Training in the Armed Forces as a "medic" also is considered good preparation for prospective EMT's.

Graduates of approved EMT training programs who meet certain experience requirements and successfully pass a written and practical examination administered by the National Registry of Emergency Medical Technicians earn the title of Registered EMT-Ambulance. To maintain their proficiency, EMT's must register again every 2 years.

Although not a general requirement for employment, registration with the National Registry is acknowledgement of an EMT's qualifications and makes higher paying jobs easier to obtain. By late 1976, nearly 70,000 EMT's were registered.

EMT's should have good dexterity and physical coordination. They must be able to lift and carry up to 100 pounds. EMT's need good eyesight (eyeglasses may be used) with accurate color vision. Normal good health is expected.

Because EMT's often work under trying conditions, they must exercise good judgment under stress and have leadership ability. Emotional stability and the ability to adapt to many different situations help them handle difficulties. They should have a neat and clean appearance and a pleasant personality.

EMT training stresses efficiency and confidence to reassure patients and bystanders.

Employment Outlook

Employment of EMT's is expected to grow much faster than the average for all occupations, due to the increasing public awareness of the need for better emergency medical services. Since passage of the Highway Safety Act of 1966 and the Emergency Medical Services System Act of 1973, the Federal Government has encouraged the expansion and improvement of ambulance services.

Additional positions for full-time EMT's will become available as more and more communities change from volunteer to paid ambulance services. A trend is underway establishing ambulance service as the third essential community service, after police and fire protection.

Increasing cooperation between ambulance personnel and the physicians and nurses of emergency departments is expected to further contribute to the growth of the emergency medical technician occupation. As the field of emergency medical care develops and personnel become more qualified, more people are expected to use ambulance services, which will increase the demand for EMT's.

In addition to job opportunities created by growth, many openings for EMT's will occur each year because of the need to replace EMT's who retire, die, or leave the labor force for other reasons.

Earnings and Working Conditions

Earnings of EMT's depend on the type of employer, the training and experience of the individual, and the geographic location.

In general, graduates of approved 81-hour training programs received starting salaries of between $7,500 and $9,000 annually in 1976, depending on the community. EMT's working for police and fire departments usually are paid the same salaries as police officers and firefighters. (See statement on police officers and firefighters elsewhere in the *Handbook*.)

A few volunteer EMT's are paid a small amount for being on call or answering emergency calls.

EMT's employed by fire departments often have a 56-hour workweek. Those employed by hospitals, private firms, and police departments usually work 40 hours a week. Volunteer EMT's have varied work schedules, but many put in from 8 to 12 hours a week. Because many ambulance services function 24 hours a day, EMT's often work nights and weekends.

The employee benefits offered by private companies, such as vacation, sick leave, and health insurance, vary widely. EMT's employed by hospitals and police and fire departments receive the same benefits as the other employees.

Sources of Additional Information

Information concerning training courses can be obtained by writing to the Emergency Medical Services Division of the Health Department of your State.

For information about job opportunities for prospective EMT's in your State, contact the Governor's Office for Highway Safety.

Information about the registration of EMT's is available upon request from:

National Registry of Emergency Medical Technicians, 1395 East Dublin-Granville Rd., P.O. Box 29233, Columbus, Ohio 43229.

MEDICAL LABORATORY WORKERS

(D.O.T. 078.128, .168, .281, and .381)

Nature of the Work

Laboratory tests play an important part in the detection, diagnosis, and treatment of many diseases. Medical laboratory workers, often called clinical laboratory workers, include three levels: medical technologists, technicians, and assistants. They perform tests under the general direction of pathologists (physicians who diagnose the causes and nature of disease) and other physicians, or scientists who specialize in clinical chemistry, microbiology, or the other biological sciences. Medical laboratory workers analyze the blood, tissues, and fluids in the human body by using precision instruments such as microscopes and automatic analyzers.

Medical technologists, who require 4 years of postsecondary training, perform complicated chemical, microscopic, and bacteriological tests. These may include chemical tests to determine, for example, the blood cholesterol level, or microscopic examination of the blood to detect the presence of diseases such as leukemia. Technologists microscopically examine other body fluids; make cultures of body fluid or tissue samples to determine the presence of bacteria, parasites, or other microorganisms; and analyze the samples for chemical content or reaction. They also may type and cross-match blood samples.

Technologists in small laboratories often perform many types of tests. Those in large laboratories usually specialize in areas such as microbiology, parasitology, biochemistry, blood banking, hematology (the study of blood cells), and nuclear medical technology (the use of radioactive isotopes to help detect diseases).

Most medical technologists conduct tests related to the examination and treatment of patients and are called on to display independent judgment. Some do research, develop laboratory techniques, teach, or perform administrative duties.

Medical laboratory technicians, who generally require 2 years of postsecondary training, perform a wide range of tests and laboratory procedures that require a high level of skill but not the in-depth knowledge of highly trained technologists. Like technologists, they may work in several areas or specialize in one field.

Medical laboratory assistants, who generally have a year of formal training, assist medical technologists and technicians in routine tests and related work that can be learned in a relatively short time. In large laboratories, they may concentrate in one area of work. For example, they may identify abnormal blood cells on slides. In addition to performing routine tests, assistants may store and label plasma; clean and sterilize laboratory equipment, glassware, and instruments; prepare solutions following standard laboratory formulas and procedures; keep records of tests; and identify specimens.

Places of Employment

About 240,000 persons worked as medical laboratory workers in 1976. Most medical laboratory personnel work in hospital laboratories. Others work in independent laboratories, physicians' offices, clinics, public health agencies, pharmaceutical firms, and research institutions. These places are concentrated in larger cities and populous States.

In 1976, Veterans Administration hospitals and laboratories employed about 2,400 medical technologists and about 2,000 medical laboratory technicians and assistants. Others worked for the Armed Forces and the U.S. Public Health Service.

Training, Other Qualifications, and Advancement

The minimum educational requirement for a beginning job as a medical technologist usually is 4 years of college training including completion of a specialized training program in medical technology.

Undergraduate work includes courses in chemistry, biological sci-

Most medical laboratory personnel work in hospitals.

ences, and mathematics. These studies give the technologist a broad understanding of the scientific principles underlying laboratory work. Specialized training usually requires 12 months of study and includes extensive laboratory work. In 1976, about 700 hospitals and schools offered programs accredited by the American Medical Association. These programs were affiliated with colleges and universities; a bachelor's degree usually is awarded upon completion. A few programs require a bachelor's degree for entry.

Many universities also offer advanced degrees in medical technology and related subjects for technologists who plan to specialize in a certain area of laboratory work or in teaching, administration, or research.

Medical laboratory technicians employed in 1976 got their training in a variety of educational settings. Many attended junior or 4-year colleges and universities for 2 years. Some were trained in the Armed Forces. Many technicians received training in private or nonprofit vocational and technical schools. In 1976 the American Medical Association accredited 38 of these programs and the Accrediting Bureau of Medical Laboratory Schools accredited 36.

Most medical laboratory assistants employed in 1976 were trained on the job. In recent years, however, an increasing number have studied in 1-year training programs conducted by hospitals, junior colleges in cooperation with hospitals, or vocational schools. In 1976, the American Medical Association accredited 153 training programs for medical laboratory assistants. Applicants to these programs should be high school graduates or have an equivalency diploma with courses in science and mathematics. The programs include classroom instruction and practical training in the laboratory. They often begin with a general orientation to the clinical laboratory followed by courses in bacteriology, serology, parasitology, hematology, clinical chemistry, blood banking, and urinalysis.

After the successful completion of the appropriate examinations, medical technologists may be certified as Medical Technologists, MT (ASCP), by the Board of Registry of the American Society of Clinical Pathologists; Medical Technologists, MT, by the American Medical Technologists; or Registered Medical Technologists, RMT, by the International Society of Clinical Laboratory Technology. These organizations also certify technicians. Laboratory assistants are certified by the American Society of Clinical Pathologists.

Medical technologists and technicians must be licensed in Alabama, California, Florida, Georgia, Hawaii, Illinois, Nevada, Pennsylvania, Tennessee, New York City, and Puerto Rico. Requirements for licensure include a written examination in some States.

Accuracy, dependability, and the ability to work under pressure are important personal characteristics for a medical laboratory worker. Manual dexterity and normal color vision are highly desirable.

Persons interested in medical laboratory careers should use considerable care in selecting a training program. They should get information about the kinds of jobs obtained by graduates, educational costs, the accreditation of the school, the length of time the training program has been in operation, instructional facilities, and faculty qualifications.

Technologists may advance to supervisory positions in certain areas of laboratory work, or, after several years' experience, to administrative medical technologist in a large hospital. Graduate education in one of the biological sciences, chemistry, management, and education usually speeds advancement. Technicians can advance to technologists by getting additional education and experience. Similarly, assistants can become technicians by acquiring more education and experience.

Employment Outlook

Employment opportunities for medical laboratory workers are expected to be favorable through the mid-1980's. Employment of these workers is expected to expand faster

than the average for all occupations as physicians make wider use of laboratory tests in routine physical checkups and in the diagnosis and treatment of disease. Indirectly influencing growth in the field are population growth, greater health consciousness, and expansion of prepayment programs for medical care that make it easier for people to pay for services.

The use of automated laboratory test equipment is expected to lead to an increase in the number of medical laboratory technicians and assistants relative to technologists. Through technological advances, technicians and assistants can operate equipment to perform tests which previously required the skill of a technologist.

Technologists will be needed to fill supervisory positions in all laboratories. Also, some will be needed in laboratories where they are required by State licensing authorities or third-party health insurance regulations, and in laboratories not using the new automated equipment.

In addition to openings resulting from growth, many jobs will become available each year because of the need to replace medical laboratory workers who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

Salaries of medical laboratory workers vary depending on the employer and geographic location. In general, medical laboratory workers employed on the West Coast and in large cities received the highest salaries.

Starting salaries for medical technologists in hospitals and medical centers averaged about $10,600 a year in 1976, according to a survey conducted by the University of Texas Medical Branch. Beginning salaries for laboratory technicians averaged about $8,700 a year in 1976; for assistants, about $7,600.

The Federal Government paid newly graduated medical technologists with bachelor's degrees starting salaries of $9,303 a year in 1977. Those having experience, superior academic achievement, or a year of graduate study entered at $11,523. The Federal Government paid medical laboratory assistants and technicians starting salaries ranging from $5,810 to $9,303 a year in 1977, depending on the amount and type of education and experience. Medical technologists in the Federal Government averaged $13,600 a year and medical technicians $11,800 a year, in 1977.

Medical laboratory personnel generally work a 40-hour week. In hospitals, they can expect some night and weekend duty. Hospitals normally provide vacation and sick leave benefits; some have retirement plans.

Laboratories generally are well-lighted and clean. Although unpleasant odors and specimens of many kinds of diseased tissue often are present, few hazards exist if proper methods of sterilization and handling of specimens, materials, and equipment are used.

Sources of Additional Information

Information about education and training for medical technologists, technicians, and laboratory assistants meeting standards recognized by the American Medical Association, the U.S. Office of Education, or both, as well as career information on these fields of work, is available from:

American Society of Clinical Pathologists, Board of Registry, P.O. Box 4872, Chicago, Ill. 60680.

American Society for Medical Technology, 5555 W. Loop South, Bellaire, Tex. 77401.

American Medical Technologists, 710 Higgins Rd., Park Ridge, Ill. 60068.

Accrediting Bureau of Medical Laboratory Schools, Oak Manor Office, 29089 U.S. 20 West, Elkhart, Ind. 46514.

For information about other technician training programs, contact:

International Society for Clinical Laboratory Technology, 805 Ambassador Building, 411 N. Seventh St., St. Louis, Mo. 63101.

For a list of training programs for medical technologists, technicians, and assistants that are approved by the American Medical Association, write:

Department of Allied Health Evaluation, American Medical Association, 535 North Dearborn St., Chicago, Ill. 60610.

For a list of training programs for medical laboratory technicians accredited by the Accrediting Bureau of Medical Laboratory Schools, write:

Secretary-ABMLS, 29089 U.S. 20 West, Elkhart, Ind. 46514.

Information about employment opportunities in Veterans Administration hospitals is available from the Office of Personnel (O54E), Veterans Administration, Washington, D.C. 20420.

Information about clinical and research employment opportunities with the National Institutes of Health is available from the Clinical Center, National Institutes of Health, Bethesda, Maryland 20014.

MEDICAL RECORD TECHNICIANS AND CLERKS

(D.O.T. 249.388)

Nature of the Work

A medical record is a permanent report on a patient's condition and course of treatment in a hospital, clinic, or other health care institution. Physicians, allied health personnel, hospital administrators, public health authorities, and insurance companies rely on these records which are kept by important members of the health care staff known as medical record technicians and clerks.

Medical record technicians and clerks perform the functions essential to maintaining the medical information system including transcription of medical data, analysis and coding of information, filing, maintenance of registries, compiling of statistics, and abstracting records.

The system used in hospitals to gather, preserve, and maintain the information for medical records requires the teamwork of many medical record technicians and clerks. In large hospitals, recordkeeping activities are supervised and coordinated by a medical record administrator,

but in smaller hospitals, experienced medical record technicians often manage the department. In most nursing homes, a medical record clerk, working under the supervision of a medical record consultant who is a Registered Record Administrator (RRA) or an Accredited Record Technician (ART), is responsible for the medical records.

Medical record clerks perform routine clerical tasks that require a minimum of specialized knowledge. They assemble the information for the records in sequence; check to see that all necessary forms, signatures, and dates are present; and locate any previous medical records that may be on file for the patient. They translate selected information such as sex, age, and referral source into a code and enter it on the records. Medical record clerks answer routine staff requests for information about patients and gather statistics for reports to various groups such as State health departments. Some medical record clerks transcribe reports of operations, X-ray and laboratory examinations, and special treatments given to patients.

Medical record clerks follow the explicit instructions and guidelines of their supervisors. Person-to-person contacts in hospitals are limited to providing readily available, nontechnical information to the hospital staff. However, in small nursing homes where only one medical record clerk is employed, there is much personal contact with the patients as well as with fellow staff members.

Analyzing records and cross-indexing medical information make up a large part of the technician's work.

Beginning medical record technicians perform duties that may be similar to those of clerks but which require more technical knowledge. The technician codes the diseases, operations, and special therapies according to recognized classification systems and enters the codes on the medical record. This coding makes it easier to refer to the record when there is a need to review the patient's case or to collect data for other purposes. Analyzing records and cross-indexing medical information make up a large part of the technician's work. Technicians do the important job of reviewing records for completeness, accuracy, and compliance with requirements, referring incomplete records to the person who compiled them. They review records for internal consistency and point out to their supervisors any apparent errors.

Technicians obtain information from records in answer to legal, governmental, and insurance company inquiries in duly authorized instances, and gather statistics and prepare periodic reports for health care facilities on types of diseases treated, types of surgery performed, and utilization of hospital beds. They also supervise medical record clerks, assist the medical staff by preparing special studies and tabulating data from records for research, and take records to court.

Places of Employment

In 1976, there were about 16,000 medical record technicians and 41,000 clerks. Although most work in hospitals, a growing number are finding jobs in clinics, nursing homes, community health centers, governmental agencies, consulting firms, and health maintenance organizations. Some medical record technicians are consultants to small health facilities. Some insurance companies employ experienced medical record technicians to collect information from patients' records to determine liability for payment. Public health departments hire medical record technicians to supervise data collection from health care institutions and to assist in research to improve health care. Manufacturers of medical record systems, services, and equipment also employ medical record personnel to help develop and market their products.

Training, Other Qualifications, and Advancement

Most employers prefer to fill technician positions with graduates from one of the colleges that have been accredited by the American Medical Association (AMA) and the American Medical Record Association (AMRA). These colleges have 2-year associate degree programs. In 1977, there were 66 such programs available. Required courses included biological sciences, medical terminology, medical record science, business management, and secretarial skills. Persons with this training who also have passed the Accredited Record Technician (ART) examination can enter the medical record field as technicians, and can often look forward to promotion to supervisory positions.

High school graduates who have basic secretarial skills can enter the medical record field as beginning clerks. About 1 month of on-the-job training will prepare them for routine tasks that do not require much specialized skill. Although they are not required, high school courses in science, health, typing, mathematics, and office practice are helpful. Medical record personnel must be accurate and pay attention to detail.

The American Medical Record Association offers a correspondence course in medical transcription that can be taken either as a home study program or as in-service training. The certificate given upon the successful completion of the course is helpful in applying for a job as a medical record clerk. Medical terms

and references learned provide a good foundation for advancement.

Some medical record clerks who have had several years of experience advance to the technician level through an approved education program, especially in areas where there is a shortage of trained medical record technicians. In the future, however, it will be increasingly difficult for clerks to become technicians without graduating from an accredited college in medical record technology. In addition, another AMRA correspondence course is available for experienced medical record clerks to prepare for the examination for accreditation as medical record technicians. Passing this examination and earning the title of ART can lead to promotion to higher paying and more responsible positions in medical records. In 1977, there were 9,240 ART's.

Employment Outlook

Employment of medical record technicians and clerks is expected to grow much faster than the average for all occupations through the mid-1980's. This employment growth will stem from a continued increase in the use of health insurance and Medicare and Medicaid, which will result in a need for more complete medical records. New jobs also will be created as nursing homes, clinics, and new types of health care facilities such as health maintenance organizations increasingly employ medical record personnel.

The outlook for technicians with a 2-year course will be favorable through the mid-1980's. It is expected that medical record technicians will be required to have this specialized training in the future as more attention is given to documenting medical care in the records in order to improve medical care delivery. As a result, technicians who have not received formal training may experience strong competition for positions from medical record technicians who have an associate degree.

Earnings and Working Conditions

Earnings of medical record clerks and technicians vary greatly according to locality. Beginning medical record clerks earned an average of $7,150 annually in private hospitals in 1976. Earnings ranged from $5,500 in small hospitals in the South to $11,000 in New York City, according to limited data. In general, salaries are highest in the big cities and lowest in rural areas. Salaries usually are higher in larger hospitals and urban areas.

Salaries of medical record technicians follow a similar geographic pattern. Limited data indicate that, in 1976, the median annual salary for ART's was $11,000. Experienced technicians who were directors of hospital medical record departments averaged $11,550. Some earned over $13,200 a year.

In Federal hospitals, medical record clerks earned a beginning annual salary of $7,408 in 1977. Annual salaries of medical record technicians ranged from $8,316 to $14,979, depending on previous experience and training. Some outstanding medical record technicians may work up to higher supervisory positions with corresponding pay increases, although most of these positions are filled by Registered Record Administrators.

Like most hospital employees, medical record personnel work a 36- to 40-hour week, receive paid holidays and vacations, health and insurance benefits, and can participate in retirement plans. Although most of the positions are full time, some part-time jobs are available.

Sources of Additional Information

A list of approved schools for medical record technicians, facts about the correspondence courses for medical transcription and medical record personnel, and additional details on the work performed by medical record technicians are available from:

American Medical Record Association, John Hancock Center, Suite 1850, 875 N. Michigan Ave., Chicago, Ill. 60611.

OPERATING ROOM TECHNICIANS

(D.O.T. 079.378)

Nature of the Work

Operating room technicians, occasionally called surgical technicians, assist surgeons and anesthesiologists before, during, and after surgery.

They help set up the operating room with the instruments, equipment, sterile linens, and fluids such as glucose that will be needed during an operation. Operating room technicians also prepare patients for surgery by washing, shaving, and disinfecting body areas where the surgeon will operate. They may transport patients to the operating room and help drape and position them on the operating table.

During surgery, they pass instruments and other sterile supplies to the surgeons. They hold retractors, cut sutures, and help count the sponges, needles, and instruments used during the operation. Operating room technicians help prepare, care for, and dispose of specimens taken for testing during the operation and help apply dressings. They may operate sterilizers, lights, suction machines, and diagnostic equipment.

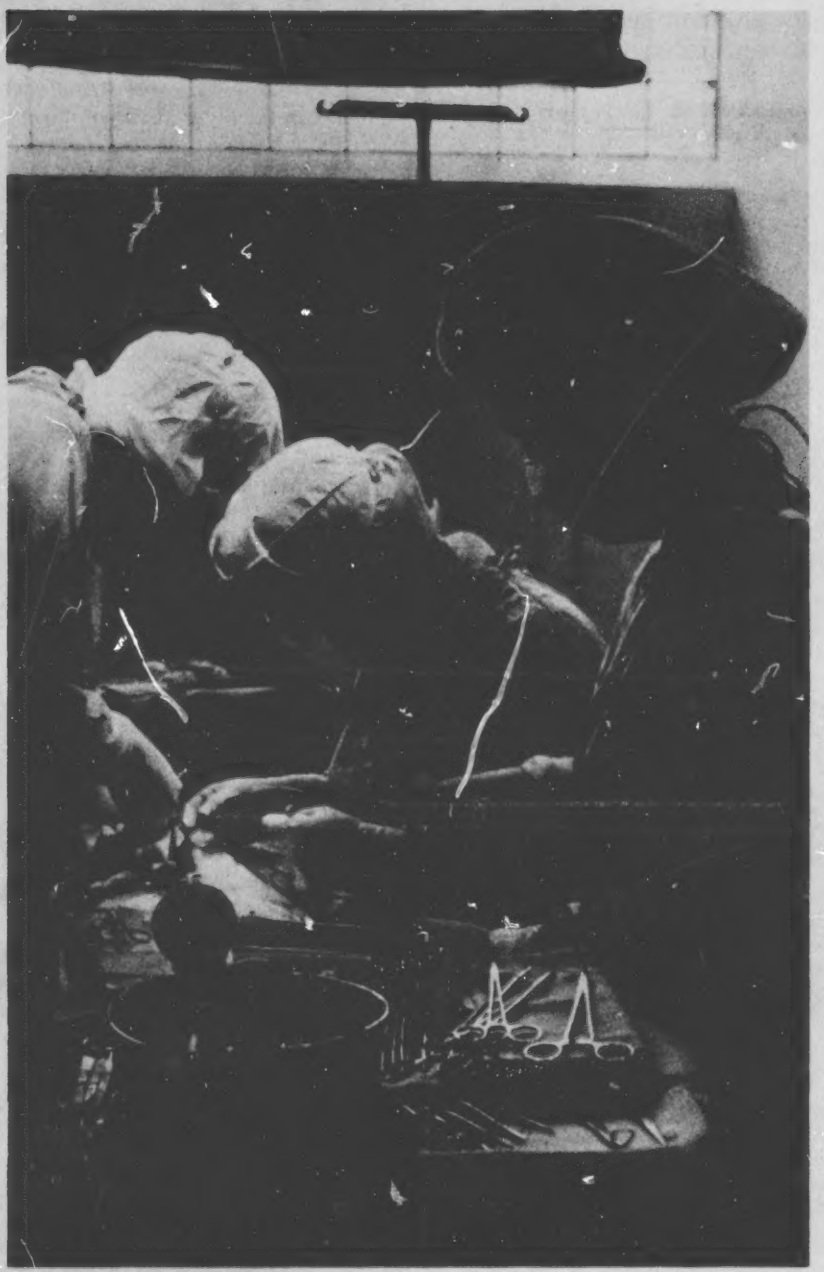
After the operation, operating room technicians help transfer patients to the recovery room and assist nurses in cleaning and stocking the operating room for the next operation.

Places of Employment

About 30,000 persons worked as operating room technicians in 1976. They worked in hospitals or other institutions that have operating room, delivery room, and emergency room facilities. In addition, many were members of the Armed Forces.

Training, Other Qualifications, and Advancement

Most operating room technicians are trained in vocational and technical schools, hospitals, and community and junior colleges. These training programs last from 9 months to 1



Operating room technician assists surgeons.

year; some junior college programs last 2 years and lead to an associate degree. Students receive classroom training as well as supervised clinical experience. Required courses include anatomy, physiology, and microbiology. Courses teaching practical applications include the care and safety of patients during surgery, use of anesthesia and its hazards, and nursing procedures. They also learn how to sterilize instruments, prevent and control infection, and handle special drugs, solutions, supplies, and equipment. In 1976, there were 46 training programs accredited by the American Medical Association.

Some operating room technicians are trained on the job. A high school education or the equivalent generally is required for entry into training and employment. On-the-job training programs in many hospitals include classroom instruction in the same type of courses taught in junior colleges and vocational schools. The length of these programs varies from 6 weeks to 1 year, depending on the trainee's qualifications and the objectives of the training given. Some hospitals prefer applicants who have worked as nursing aides or practical nurses.

Some operating room technicians receive training in the Armed Forces.

The Association of Operating Room Technicians awards a certificate to operating room technicians who pass their comprehensive examination. A Certified Operating Room Technician (CORT) is recognized as competent in the field and generally is paid a higher salary.

Manual dexterity is a necessity for operating room technicians because they must handle various instruments quickly. They must be orderly and emotionally stable. High school students interested in careers in this occupation are advised to take courses in health and biology.

Operating room technicians may advance to the positions of assistant operating room administrator and assistant operating room supervisor. Assistant operating room administrators deal with the administrative aspects of running an operating room, such as ordering supplies and arranging work schedules, while assistant operating room supervisors actually work in the operating room itself, directing other operating room technicians.

Employment Outlook

Employment opportunities for operating room technicians are expected to be good through the mid-1980's. Graduates of 2-year community and junior college programs should be especially in demand.

Employment in this field is expected to grow faster than the average for all occupations as operating room technicians increasingly assume more of the routine nursing tasks in the operating room. The same factors that contribute to the demand

for health workers in general apply to operating room technicians—population growth and the increased ability of people to pay for medical care due to expansion in coverage under prepayment insurance programs.

In addition to job openings resulting from growth of the occupation, many new operating room technicians will be needed to replace workers who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

The average starting salary for operating room technicians was about $7,400 a year in 1976, according to a national survey conducted by the University of Texas Medical Branch. Experienced technicians earned average salaries of approximately $9,300 annually. In 1977, the Federal Government paid operating room technicians starting salaries of $8,316 a year. Most experienced operating room technicians employed by the Federal Government received annual salaries of $10,370.

Graduates of training programs in hospitals and community and junior colleges often earn higher salaries than workers without formal training. Salaries, reflecting variations in the cost of living, also vary widely by geographic location, with those on the East and West Coasts generally higher. Usually, operating room technicians earn about as much as the average for all nonsupervisory workers in private industry, except farming.

Operating room technicians usually work a 5-day, 40-hour week. However, they may be required to work "on call" shifts (staying available to work on short notice).

Sources of Additional Information

Additional information on a career as an operating room technician and on training programs for the occupation is available from:

Association of Operating Room Technicians, Inc., 1100 West Littleton Blvd., Suite 201, Littleton, Colo. 80120.

Information on the operating room technician occupation also is available from:

American Medical Association, Department of Allied Health Evaluation, 535 North Dearborn St., Chicago, Ill. 60610.

OPTOMETRIC ASSISTANTS

Nature of the Work

Optometric assistants perform a wide variety of tasks, allowing optometrists to devote more time to their professional duties. They keep patients' records, schedule appointments, and handle bookkeeping, correspondence, and filing. They prepare patients for eye examinations, take initial case histories, and record the results of optometrists' examinations. Optometric assistants measure patients for correct and comfortable fit of glasses. They suggest size and shape of eyeglass frames to compliment the patient's facial features, and adjust finished eyeglasses by heating, shaping, and bending the plastic or metal frames. They also assist the optometrist in giving instructions on the wear and care of contact lenses.

Optometric assistants help patients with exercises for eye coordination to overcome focusing defects. In the laboratory, they adjust conventional glasses to assure proper fit, insert lenses in frames, repair frames, keep an inventory of optometric materials, and clean and care for the instruments.

In a large optometric complex, assistants may specialize in visual training, chairside assistance, or office administration. In a smaller practice, they may perform all these duties.

Places of Employment

About 11,800 persons, worked as optometric assistants in 1976. Most worked for optometrists in private practice. Others worked for health clinics. Some served as assistants to optometrists in the Armed Forces.

Training, Other Qualifications, and Advancement

Most optometric assistants are trained on the job in their employers' offices. Training also can be acquired in 1-year academic courses; 11 schools offered this type of training in 1976. More detailed training in the technical aspects of optometry was available in 20 schools that offered 2-year courses leading to an associate degree. In addition, the U.S. Air Force trained optometric specialists in an accelerated, 16-week training program.

High school graduation or its equivalent, including courses in mathematics and office procedures, is a preferred background for admission to a formal training program or on-the-job training. All of the formal programs offer specialized courses such as the anatomy and physiology of the human eye, vision training (the use of exercises to correct defective vision), and contact lens theory and practice. Programs also include courses in secretarial and office procedures. Lectures and laboratory work are supplemented by actual experience in optometric clinics and practices.

Although most newly hired optometric assistants currently are trained on-the-job, optometrists prefer to hire assistants who are graduates of 1- or 2-year formal training programs. This training will become more important in gaining initial employment and advancement as more programs become available.

Manual dexterity and accuracy are requirements for persons planning to become optometric assistants. Because of the person-to-person work relationship between optometric assistants and patients, a neat appearance, courtesy, and tact are important qualifications.

Employment Outlook

The employment of optometric assistants is expected to grow faster than the average for all occupations through the mid-1980's. Employment opportunities for optometric assistants who have completed one of the formal training programs should be excellent. On-the-job training,

Most optometric assistants are trained on the job in their employers' offices.

however, probably will continue to be the means by which many persons enter the occupation. Many opportunities for part-time work will continue to be available.

Factors underlying the expected growth of the occupation are the increase in population and greater demand for eye care services. As the number of patients served by optometrists increase, more trained assistants will be needed.

Earnings and Working Conditions

Earnings of optometric assistants vary by geographical region, academic and technical qualifications, and the size and type of practice of the optometrists employing them. In 1976, beginning salaries ranged from $100 a week for optometric assistants having no training or experience to $160 a week for experienced and highly trained assistants, according to limited information available.

Most optometric assistants work between 30 and 40 hours a week. Occasionally they may work a few hours on Saturday. The work is not strenuous and physical surroundings are usually pleasant.

Sources of Additional Information

Further information on a career as an optometric assistant and a list of training programs are available from:

American Optometric Association, 7000 Chippewa St., St. Louis, Mo. 63119.

RADIOLOGIC (X-RAY) TECHNOLOGISTS

(D.O.T. 078.168 and .368)

Nature of the Work

Bone fractures, ulcers, blood clots, and brain tumors are just a few of the medical problems that involve the use of X-rays in their treatment, either for diagnosis or therapy. X-rays are also taken of the chest during routine medical checkups to detect the presence of lung diseases in the early stages. The people who operate X-ray equipment and take X-ray pictures (known as radiographs) are called radiologic technologists. They usually work under the supervision of radiologists—physicians who specialize in the use of X-rays.

Within the field of radiologic technology there are three specialties. The most widely known is X-ray technology, taking X-rays of parts of the human body for study by a radiologist in diagnosing a patient's problem. The other two branches are nuclear medicine technology—the application of radioactive material to help radiologists diagnose or treat illnesses or injuries—and radiation therapy, the use of radiation-producing machines to give therapeutic treatments recommended by radiologists. Radiologic technologists work in all three areas.

Before a radiologic technologist can perform any work on a patient, a physician must issue a requisition ordering the work done. Similar to prescriptions for drugs, these requisitions assure that radiologic technologists treat only those people certified as needing such treatment by physicians.

Radiologic technologists prepare patients for X-ray examinations, assuring that they remove any articles of clothing, such as belt buckles or jewelry, through which X-rays cannot pass. They then position the patients, either on a table or standing, so that the correct parts of the body can be radiographed, always taking care not to aggravate injuries or make the patients uncomfortable. To prevent unnecessary X-ray exposure to unaffected parts, the technologist surrounds the exposed area with radiation protection devices, such as lead plates.

After the necessary preparations, the technologist positions the X-ray machine at the correct angle and height over the appropriate area of a patient's body. Using instruments like a measuring tape, the technologist estimates the thickness of the section to be radiographed. He or she sets the proper controls on the machine, such as those regulating exposure time, to produce X-rays of the right density, detail, and contrast.

The technologist then places a properly identified X-ray film of the correct size under the part of the patient's body to be examined, and turns on the machine. Afterward, the technologist removes the film and develops it for analysis by a radiologist. Throughout the procedure, the technologist is careful to use only as much radiation as is necessary to obtain a good diagnostic examination.

When examining a patient using fluoroscopy (watching a patient's internal body movements on a monitor or screen), the radiologic technologist prepares a solution of barium sulphate for the patient to drink. As this solution passes through the patient's digestive tract, a physician looks for diseases, injuries, or defects in the patient's digestive system. When fluoroscopic examinations are performed, whether on the digestive tract or on other parts of the body such as chest, heart, or bones, the technologist assists the physician by properly preparing and positioning the patient, adjusting the machine, and applying the correct exposure.

In radiation therapy, which is mainly used for treating cancer, the radiologic technologist works under the close supervision of a radiologist. Directed by a radiologist, the technologist applies the correct amount of radiation for the proper period of time to the affected part of the patient's body. The technologist also must keep adequate records of the treatment and is responsible for the comfort and safety of the patient during the treatment time.

In nuclear medicine, the radiologic technologist also works under the direct supervision of a radiologist. This technologist prepares solutions containing radioactive material that, when swallowed by the patient or injected, is absorbed by the patient's internal organs. Because diseased tissues generally react differently from healthy ones when subjected to radioactive substances, it is possible to trace the development of disease. The technologist uses special cameras or scanners that pick up the radioactivity, and operates instruments that measure the intensity of the radioactivity.

In addition to the duties involved in operating X-ray equipment, radiologic technologists may have certain administrative tasks. Technologists prepare and maintain patients' records—keeping track of the developed film, the date it was taken, and the radiologist's diagnosis. They also may maintain files, schedule appointments, and prepare work schedules for assistants.

Some radiologic technologists are full-time instructors in X-ray techniques, teaching in programs of radiologic technology.

Places of Employment

About 80,000 persons worked as radiologic technologists in 1976. Hospitals employ about three-fourths of all radiologic technologists; most of the remainder work in medical laboratories, physicians' and dentists' offices or clinics, Federal and State health agencies, and public school systems.

Training, Other Qualifications, and Advancement

The requirement for entry into this field is the completion of a formal education program in X-ray technology. In 1976, about 1,100 programs in X-ray technology offered by hospitals, medical schools affiliated with hospitals, colleges, and universities were approved by the American Medical Association (AMA).

Education also may be obtained in the military service or through courses in X-ray technology offered by vocational or technical schools. Programs vary in length from 2 to 4 years. Some colleges award a baccalaureate degree in radiologic technology. While employers generally pay graduates of bachelor's degree programs the same starting salaries as those of 2- and 3-year programs, there is more potential for promotion for those holding the baccalaureate degree. It is advantageous for those planning to be educators or administrators in this field to pursue the baccalaureate and master's degrees as preparation.

All programs accept only high school graduates or the equivalent. Courses in mathematics, physics, chemistry, biology, and typing are helpful.

X-ray technology programs include courses in anatomy, physiology, nursing procedures, physics, radiation protection, film processing, principles of radiographic exposure, medical terminology, radiographic positioning, medical ethics, and department administration.

Registration with the American Registry of Radiologic Technologists is an asset in obtaining highly skilled and specialized positions. Registration requirements include graduation from an approved program of medical X-ray technology and the satisfactory completion of a written examination. After registration, the title "Registered Technologist (ARRT)" may be used. Once registered, technologists may be certified in radiation therapy or nuclear medicine by completing an additional year of combined classroom study and clinical education.

Good health, emotional stability, and a sincere desire to work with the sick and disabled are important qualifications for this field.

As openings occur, some technologists in large X-ray departments may qualify as instructors in X-ray techniques or advance to supervisory X-ray technologists.

Employment Outlook

Employment in the field of radiologic technology is expected to expand faster than the average for all occupations through the mid-1980's as X-ray equipment is increasingly used to diagnose and treat diseases. The demand for radiologic technologists also will increase as prepaid medical programs extend medical care to wider segments of the population. Part-time workers will find the best opportunities in physicians' offices and clinics where full-time radiologic services usually are not required.

Although the demand for radiologic technologists should continue to be strong, the number of graduates of AMA-approved programs in this field also is expected to grow rapidly during the period. If present enrollment patterns continue, the number

seeking to enter the occupation is likely to exceed the number of openings from growth and replacement needs. As a result, graduates may face competition for positions of their choice.

Earnings and Working Conditions

Starting salaries of radiologic technologists employed in hospitals and medical centers averaged about $9,000 a year in 1976, according to a national survey conducted by the University of Texas Medical Branch. Experienced radiologic technologists averaged $11,300 a year, or slightly more than the average for all nonsupervisory workers in private industry, except farming.

The Federal Government paid new graduates of AMA-approved schools of X-ray technology starting salaries of $8,316 a year in 1977.

Full-time technologists generally work 8 hours a day and 40 hours a week but may be "on call" for some weekend or night emergency duty. Sick leave, vacations, insurance, and other benefits are comparable to those covering other workers in the same organization.

There are potential radiation hazards in this field; however, these hazards have been greatly reduced by the use of safety devices such as instruments that measure radiation exposure, lead aprons, gloves, and other shielding.

Sources of Additional Information

For additional information about programs and careers in radiologic technology, write:

The American Society of Radiologic Technologists, 500 N. Michigan Ave., Suite 836, Chicago, Ill. 60611.

RESPIRATORY THERAPY WORKERS

(D.O.T. 079.368)

Nature of the Work

Respiratory therapy workers, sometimes called inhalation therapy workers, treat patients with cardiorespiratory problems. This treatment may range from giving temporary relief to patients with chronic asthma or emphysema to giving emergency care in cases of heart failure, stroke, drowning, and shock. Respiratory therapy workers also are among the first medical specialists called for emergency treatment of acute respiratory conditions arising from head injury or drug poisoning. The therapy worker's role is a highly responsible one because if a patient stops breathing for longer than 3 to 5 minutes, there is little chance of recovery without brain damage, and if oxygen is cut off for more than 9 minutes, death results.

Following doctors' orders, respiratory therapy workers use special equipment such as respirators and positive-pressure breathing machines to treat patients who need temporary or emergency respiratory assistance. For example, they use aerosol inhalants to administer medication so that it is confined to the lungs. They also show patients and their families how to use equipment at home. Other duties include keeping records of the cost of materials and charges to patients, and maintaining and making minor repairs to equipment.

There are three levels of workers within the field of respiratory therapy: therapists, technicians, and assistants. Therapists and technicians perform essentially the same duties. However, the therapist is expected to have a higher level of expertise and may be expected to assume some teaching and supervisory duties. Respiratory assistants have little contact with patients and spend most of their time taking care of the equipment, including cleaning, sterilizing, and storing it. Many are new to the job and are training to advance to the technician or therapist level.

Places of Employment

About 36,000 persons worked as respiratory therapists, technicians, or assistants in 1976. Most work in hospitals, in respiratory therapy, anesthesiology, or pulmonary medicine departments. Others work for oxygen equipment rental companies, ambulance services, nursing homes, and universities.

Training, Other Qualifications, and Advancement

Respiratory apparatus has become increasingly complex in recent years and, although a few respiratory therapy workers are trained on the job, formal training now is stressed for entry to the field.

In 1976, about 200 institutions offered programs in respiratory therapy that were approved by the Council on Medical Education of the American Medical Association. High school graduation is required for entry to these programs. Courses vary in length between 18 months and 4 years and include both theory and clinical work. A bachelor's degree is awarded for completion of a 4-year program and an associate degree for shorter courses. Areas of study include human anatomy and physiology, chemistry, physics, microbiology, and mathematics. Technical courses offered deal with procedures, equipment, and clinical tests.

Respiratory therapists who have a certificate of completion from an AMA-approved therapist training program, 62 semester hours of college credit, and 1 year of experience following completion of the program are eligible to apply for registration by the National Board for Respiratory Therapy (NBRT). The registry examination consists of written and oral tests. Applicants must pass both to be awarded the Registered Respiratory Therapist (RRT) credential. In 1976, about 4,500 therapists had been registered.

Individuals who complete an AMA-approved technician training program and have 1 year of experience in respiratory therapy may apply to the NBRT for examination for the Certified Respiratory Therapy Technician (CRTT) credential. The CRTT examination is less comprehensive than the registry examination and consists of a single written test. Approximately 16,000 respiratory technicians had been certified in 1976.

In contrast to therapists and technicians, there are no general requirements for the position of respiratory

assistant. The only requirements are those set by the head of the hospital department that is hiring workers. For example, some may require only a high school diploma.

Respiratory therapists can advance to assistant chief, chief therapist, or, with graduate education, to instructor of respiratory therapy at the college level. Respiratory technicians and assistants can advance to the therapist level by taking the appropriate training courses.

People who want to enter the respiratory therapy field should enjoy working with patients and should understand their physical and psychological needs. Respiratory therapy workers must be able to pay attention to detail, follow instructions, and work as part of a team. Operating the complicated respiratory therapy equipment also requires mechanical ability and manual dexterity. High school students interested in a career in this field are encouraged to take courses in health, biology, mathematics, physics, and bookkeeping.

Employment Outlook

Employment opportunities for respiratory therapy workers are expected to be good through the mid-1980's. Those with advanced training in respiratory therapy will be in demand to fill teaching and supervisory positions.

Employment of respiratory therapy workers is expected to grow much faster than the average for all occupations. Stimulating demand will be new and expanding uses for respiratory therapy and the growth in health services in general. Many specialists in respiratory therapy will be hired to release nurses and other personnel from respiratory therapy work; other openings will arise from the need to replace those who retire, die, or leave the occupation for other reasons.

Operation of respiratory equipment requires mechanical ability and manual dexterity.

Earnings and Working Conditions

The starting salary of respiratory therapists employed in hospitals and medical centers averaged about $9,900 a year in 1976, according to a survey conducted by the University of Texas Medical Branch. Top salaries of experienced respiratory therapists in hospitals ranged as high as $17,600 a year. Salaries of respiratory technicians and assistants are lower than those of respiratory therapists.

The Federal Government paid respiratory therapists starting salaries of $7,408 a year in 1977 if they had 1 year of AMA-accredited postsecondary training, and $8,316 for those with 2 years of AMA-accredited training.

Respiratory therapy workers in hospitals receive the same benefits as other hospital personnel, including hospitalization, paid vacations, and sick leave. Some institutions provide tuition assistance or free courses, pension programs, uniforms, and parking.

Respiratory therapy workers generally have a 40-hour week. Afterhours and weekend duty is generally required because most hospitals have 24-hour coverage throughout the week. Adherence to safety precautions and regular testing of equipment minimize the potential hazard of fire to workers and patients.

Sources of Additional Information

Information concerning education programs is available from:

American Association for Respiratory Therapy, 7411 Hines Place, Dallas, Tex. 75235.

Information on the certification of respiratory therapists and respiratory technicians can be obtained from:

The National Board for Respiratory Therapy, Inc., 1900 West 47th Place, Suite 124, Shawnee Mission, Kansas 66205.

On-the-job training information can be obtained at local hospitals.

NURSING OCCUPATIONS

The nursing field, consisting of registered nurses; licensed practical nurses; and nursing aides, orderlies, and attendants, accounts for about one-half of total employment among health service workers. Nursing personnel perform a variety of duties to care for and comfort the sick, the injured, and others requiring medical services.

This section deals in detail with the three basic nursing occupations.

Registered nurses (*RN's*) follow the medical regimen prescribed by physicians but often must draw on their professional training to make independent judgments in providing nursing services. Some registered nurses, after advanced training, become *nurse practitioners* and perform services, such as physical examinations, that traditionally have been handled by physicians. Some nurses become head nurses with responsibility for all nursing services of a specified area of an institution, for example, a pediatrics ward.

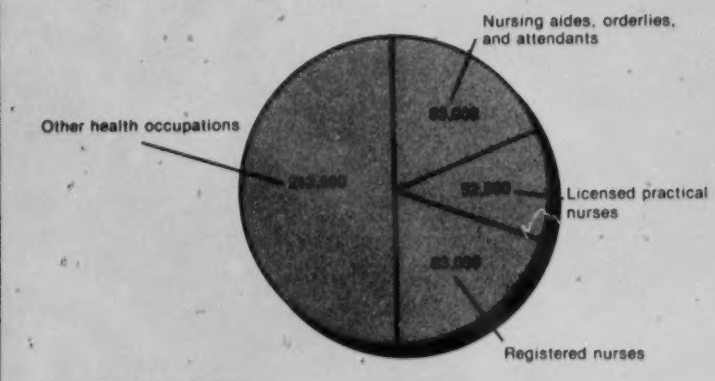
Licensed practical nurses provide skilled nursing care to sick, injured, and convalescent patients. They work under the general supervision of physicians and registered nurses, and may sometimes supervise nursing aides, orderlies, and attendants.

Nursing aides, orderlies, and attendants make up the largest group of nursing personnel. They serve meals, feed patients, and do other tasks that free professional and practical nurses for work requiring professional and technical training.

Persons who wish to become registered nurses, licensed practical nurses, or nursing aides, orderlies, and attendants should like working with people because they must work closely with other members of the health team and care for patients who are uncomfortable and sometimes irritable. Nursing workers must be reliable and keep a level head in emergencies.

About 50 percent of the job openings in health occupations during the next 10 years will be for nursing personnel

Average annual openings, 1976-85



Source: Bureau of Labor Statistics

REGISTERED NURSES

(D.O.T. 075.118 through .378)

Nature of the Work

Nursing plays a major role in health care. As important members of the health care team, registered nurses perform a wide variety of functions. They observe, evaluate, and record symptoms, reactions, and progress of patients; administer medications; assist in the rehabilitation of patients; instruct patients and family members in proper health maintenance care; and help maintain a physical and emotional environment that promotes recovery.

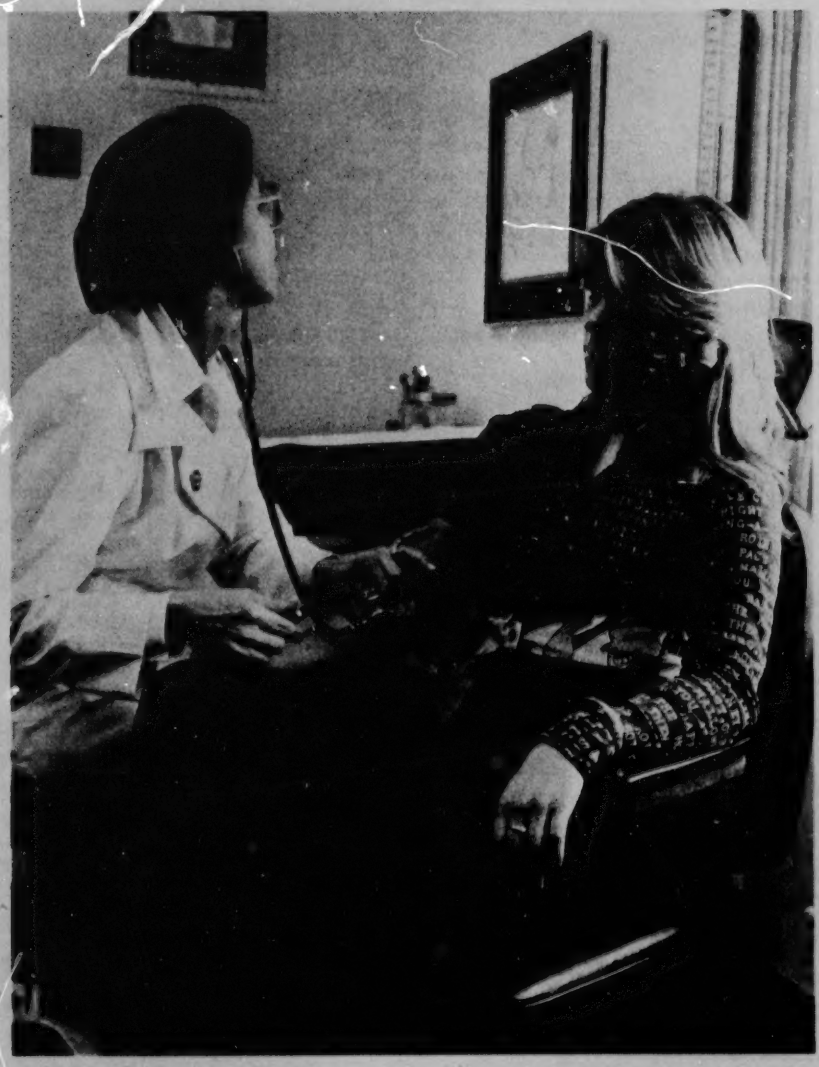
Some registered nurses provide hospital care. Others perform research activities or instruct students. The setting usually determines the scope of the nurse's responsibilities.

Hospital nurses constitute the largest group of nurses. Most are staff nurses who provide skilled bedside nursing care and carry out the medical treatment prescribed by physicians. They may also supervise practical nurses, aides, and orderlies. Hospital nurses usually work with groups of patients that require similar nursing care. For instance, some nurses work with patients who have had surgery; others care for children, the elderly, or the mentally ill. Some are administrators of nursing services.

Private duty nurses give individual care to patients who need constant attention. The private duty nurse is self-employed and may work in a home, in a hospital, or in a convalescent institution.

Office nurses assist physicians, dental surgeons, and occasionally dentists in private practice or clinics. Sometimes they perform routine laboratory and office work in addition to their nursing duties.

Community health nurses care for patients in clinics, homes, schools, and other community settings. They instruct patients and families in health care and give periodic care as prescribed by a physician. They may also instruct groups of patients in proper diet and arrange for immunizations. These nurses work with com-



Employment opportunities for registered nurses are expected to be favorable through the mid-1980's.

munity leaders, teachers, parents, and physicians in community health education. Some community health nurses work in schools.

Nurse educators teach students the principles and skills of nursing, both in the classroom and in direct patient care. They also conduct continuing education courses for registered nurses, practical nurses, and nursing assistants.

Occupational health or industrial nurses provide nursing care to employees in industry and government and, along with physicians, promote employee health. As prescribed by a doctor, they treat minor injuries and illnesses occurring at the place of employment, provide for the needed nursing care, arrange for further medical care if necessary, and offer health counseling. They also may assist with health examinations and inoculations.

(Licensed practical nurses who also perform nursing services are discussed elsewhere in the *Handbook*.)

Places of Employment

About 960,000 persons worked as registered nurses in 1976. About one-third worked on a part-time basis.

About three-quarters of all registered nurses worked in hospitals, nursing homes, and related institutions. Community health nurses in government agencies, schools, visiting nurse associations, and clinics numbered about 65,000; nurse educators in nursing schools accounted for about 33,000; and occupational health nurses in industry, about 20,000. About 100,000 more worked in the offices of physicians or other health practitioners, or were private duty nurses hired directly by patients. Most of the others were staff members of professional nurse and other organizations or worked for State boards of nursing or research organizations.

Training, Other Qualifications, and Advancement

A license is required to practice professional nursing in all States and in the District of Columbia. To get a license, a nurse must be a graduate of a school of nursing approved by the State board of nursing and pass a written State competency examination. Nurses may be licensed in more than one State, either by examination or endorsement of a license issued by another State.

Three types of educational programs—diploma, baccalaureate, and associate degree—prepare candidates for licensure. However, a minimum of a baccalaureate degree is preferred for those who aspire to administrative or management positions, and those planning to work in research, consultation, teaching, or clinical specialization, which require education at the master's level. Graduation from high school is required for admission to all schools of nursing.

Diploma programs are conducted by hospital and independent schools and usually require 3 years of training. Bachelor's degree programs usually require 4 years of study in a college or university, although a few require 5 years. Associate degree programs in junior and community colleges require approximately 2 years of nursing education. In addition, several programs provide licensed practical nurses with the training necessary to upgrade them-

selves to registered nurses while they continue to work part time. These programs generally offer an associate of arts degree. In 1976, about 1,375 programs (associate, diploma, and baccalaureate) were offered in the United States. In addition, there were 102 master's degree and 12 doctoral degree programs in nursing.

Programs of nursing include classroom instruction and supervised nursing practice in hospitals and health facilities. Students take courses in anatomy, physiology, microbiology, nutrition, psychology, and nursing. They also get supervised clinical experience in the care of patients who have different types of health problems. Students in bachelor's degree programs as well as in some of the other programs are assigned to community agencies to learn how to care for patients in clinics and in the patients' homes. Varying amounts of general education are combined with nursing education in all three types of programs.

Students who need financial aid may qualify for federally sponsored nursing scholarships or low-interest loans. Those who want to pursue a nursing career should have a sincere desire to serve humanity and be sympathetic to the needs of others. Nurses must be able to accept responsibility and direct or supervise the activity of others; must have initiative, and in appropriate situations be able to follow orders precisely or determine if additional consultation is required; and must use good judgment in emergencies. Good mental health is needed in order to cope with human suffering and frequent emergency situations. Staff nurses need physical stamina because of the amount of time spent walking and standing.

From staff positions in hospitals, experienced nurses may advance to head nurse, assistant director, and director of nursing services. A master's degree, however, often is required for supervisory and administrative positions, as well as for positions in nursing education, clinical specialization, and research. Public health agencies require a baccalaureate degree for employment. Advancement may be difficult for nurses who do not have a baccalaureate or master's degree in community health nursing.

A growing movement in nursing, generally referred to as the "nurse practitioner program" is opening new career possibilities. Several post-baccalaureate programs prepare nurses for highly independent roles in the clinical care and teaching of patients. These nurses practice in primary roles that include pediatrics, geriatrics, community health, mental health, and medical-surgical nursing.

Employment Outlook

Employment opportunities for registered nurses are expected to be favorable through the mid-1980's. Some competition for more desirable, higher paying jobs is expected in areas where training programs abound, but opportunities for full- or part-time work in present shortage areas, such as some southern States and many inner-city locations, are expected to be very good through 1985. For nurses who have had graduate education, the outlook is excellent for obtaining positions as administrators, teachers, clinical specialists, and community health nurses.

Growth in employment of registered nurses is expected to be faster than the average for all occupations because of extension of prepayment programs for hospitalization and medical care, expansion of medical services as a result of new medical techniques and drugs, and increased interest in preventive medicine and rehabilitation of the handicapped. In addition to the need to fill new positions, large numbers of nurses will be required to replace those who leave the field each year.

Earnings and Working Conditions

Registered nurses who worked in hospitals in 1976 received average starting salaries of $11,820 a year, according to a national survey conducted by the University of Texas Medical Branch. This was above the average for nonsupervisory workers in private industry, except farming. Registered nurses in nursing homes can expect to earn slightly less than those in hospitals. Salaries of industrial nurses averaged $240 a week in mid-1976, according to a survey conducted by the Bureau of Labor Statistics.

In 1977, the Veterans Administration paid inexperienced nurses who had a diploma or an associate degree starting salaries of $10,370 a year; those with baccalaureate degrees, $12,131. Nurses employed in all Federal Government agencies earned an average of $15,500 in 1977.

Most hospital and nursing home nurses receive extra pay for work on evening or night shifts. Nearly all receive from 5 to 13 paid holidays a year, at least 2 weeks of paid vacation after 1 year of service, and also some type of health and retirement benefits.

Sources of Additional Information

For information on approved schools of nursing, nursing careers, loans, scholarships, salaries, working conditions, and employment opportunities, contact:

Coordinator, Undergraduate Programs, Department of Nursing Education, American Nurses' Association, 2420 Pershing Rd., Kansas City, Mo. 64108.

For career information and a list of schools of nursing, contact:

Career Information Services, National League for Nursing, 10 Columbus Circle, New York, N.Y. 10019.

Information about employment opportunities in the Veterans Administration is available from:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

LICENSED PRACTICAL NURSES

(D.O.T. 079.378)

Nature of the Work

Licensed practical nurses (LPN's) help care for the physically or mentally ill and infirm. Under the direction of physicians and registered nurses, they provide nursing care

that requires technical knowledge but not the professional education and training of a registered nurse. (See statement on registered nurses.) In California and Texas, licensed practical nurses are called *licensed vocational nurses.*

In hospitals, LPN's provide much of the bedside care needed by patients. They take and record temperatures and blood pressures, change dressings, administer certain prescribed medicines, and help patients with bathing and other personal hygiene. They assist physicians and registered nurses in examining patients and in carrying out nursing procedures. They also assist in the delivery, care, and feeding of infants. Some practical nurses work in specialized units such as intensive care units, recovery rooms, or burn units. They perform special nursing procedures and operate sophisticated equipment to provide care for seriously ill or injured patients. In some instances, experienced LPN's supervise hospital attendants and nursing aides. (See statement on nursing aides, orderlies, and attendants.)

LPN's who work in private homes provide day-to-day patient care that seldom involves highly technical procedures or complicated equipment. In addition to providing nursing care, they may prepare meals, see that patients are comfortable and help keep up their morale. They also teach family members how to perform simple nursing tasks.

In doctors' offices and in clinics, LPN's prepare patients for examination and treatment, administer medications, apply dressings, and teach patients prescribed health care regimens. They also may make appointments and record information about patients.

LPN's provide much of the bedside care needed by hospital patients.

Places of Employment

In 1976, about 460,000 persons worked as LPN's—about three-fifths of them in hospitals. Most of the others worked in nursing homes, clinics, doctors' offices, sanitariums, and other long-term care facilities. Many worked for public health agencies and welfare and religious organizations. Some self-employed nurses worked in hospitals or in the homes of their patients.

Training, Other Qualifications, and Advancement

All States and the District of Columbia regulate the preparation and licensing of practical nurses. To become licensed, applicants must complete a course of instruction in practical nursing that has been approved by the State board of nursing and pass a written examination. Educational requirements for enrollment in State-approved training programs range from completion of eighth or ninth grade to high school graduation. Many schools do not require completion of high school but they give preference to graduates. Physical examinations and aptitude tests are usually required. Volunteer hospital work can provide a useful background for practical nursing, but most applicants have no prior work experience.

In 1976, over 1,350 State-approved programs provided practical nursing training. Trade, technical, or vocational schools offered more than half of these programs. Other programs were available at junior colleges, local hospitals, health agencies, and private educational institutions. Several programs operated by the Army for military personnel also were State-approved for practical nurse training. Graduates from these programs are eligible for licensure.

Practical nurse training programs are generally 1 year long and include both classroom study and clinical practice. Classroom instruction cov-

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ers nursing concepts and principles and related subjects including anatomy, physiology, medical-surgical nursing, pediatrics, obstetrics, psychiatric nursing, administration of drugs, nutrition, first aid, and comply their skill to an actual nursing situation through supervised clinical experience—usually in a hospital.

Those who wish to become licensed practical nurses should have a deep concern for human welfare. They must be emotionally stable because working with sick and injured people sometimes can be upsetting.

As part of a health care team, they must be able to follow orders and work under close supervision. Good health is very important, as is the physical stamina needed to work while standing a great deal.

Advancement opportunities are limited without additional training or formal education. In-service educational programs prepare some LPN's for work in specialized areas, such as post-surgery recovery rooms, or intensive care units. Under career ladder programs, nurses' aides may attend training to become LPN's while continuing to work part-time. Similarly, in some cases, LPN's may prepare to become registered nurses while they continue to work part-time.

Employment Outlook

The employment outlook for LPN's is expected to be very good through the mid-1980's. Employment is expected to continue to rise much faster than the average for all occupations in response to the needs of a growing population and expanded public and private health insurance plans. Also, newly licensed practical nurses will be needed each year in large numbers to replace those who die, retire, or leave the occupation for other reasons.

Earnings and Working Conditions

The average starting salary of LPN's in hospitals was about $9,100 a year in 1976, according to a national survey conducted by the University of Texas Medical Branch.

Federal hospitals offered beginning LPN's an annual salary of $7,408 in 1977.

Many hospitals give pay increases after specific periods of satisfactory service. Practical nurses generally work 40 hours a week, but often this workweek includes some work at night and on weekends and holidays. Many hospitals provide paid holidays and vacations, health insurance, and pension plans.

In private homes, LPN's usually work 8 to 12 hours a day and go home at night. Private duty nursing affords a great deal of independence to the practical nurse in setting work hours and determining the length and frequency of vacations.

Sources of Additional Information

A list of State-approved training programs and information about practical nursing is available from:

National League for Nursing, 10 Columbus Circle, New York, N.Y. 10019.

National Association for Practical Nurse Education and Service, Inc., 122 East 42d St., Suite 800, New York, N.Y. 10017.

For information about a career in practical nursing, contact:

National Federation of Licensed Practical Nurses, Inc., 250 West 57th St., New York, N.Y. 10019.

Information about employment opportunities in U.S. Veterans Administration hospitals is available from your local Veterans Administration hospital, as well as:

Department of Medicine and Surgery, Veterans Administration, Washington, D.C. 20420.

NURSING AIDES, ORDERLIES, AND ATTENDANTS

(D.O.T. 355.687 through .887)

Nature of the Work

Nursing aides, orderlies, and attendants perform a variety of duties to care for sick and injured people. Other job titles include *hospital attendant*, *nursing assistant*, *auxiliary nursing worker*, *geriatric aide*, and (in mental institutions) *psychiatric aide*.

Nursing aides and orderlies answer patients' bell calls and deliver messages, serve meals, feed patients who are unable to feed themselves, make beds, and bathe and dress patients. They also may give massages, take temperatures, and assist patients in getting out of bed and walking. Orderlies escort patients to operating and examining rooms and transport and set up heavy equipment. Some attendants may work in hospital pharmacies or supply rooms storing and moving supplies.

The duties of nursing aides depend on the policies of the institutions where they work, the type of patient being cared for, and—equally important—the capacities and resourcefulness of the nursing aide or orderly. In some hospitals, they may clean patients' rooms and do other household tasks. In others, under the supervision of registered nurses and licensed practical nurses, they may assist in the care of patients. The tasks performed for patients differ considerably, and depend on whether the patient is confined to bed following major surgery, is recovering after a disabling accident or illness, or needs assistance with daily activities because of infirmity caused by advanced age.

Another occupation similar to nursing aide is *homemaker-home health aide*. Working in the homes of patients, they perform duties similar to those of nursing aides, as well as doing the cooking and other light housework. (See statement on homemaker-home health aides elsewhere in the *Handbook*.)

Places of Employment

About 1 million persons worked as nursing aides, orderlies, and attendants in 1976. Most work in hospitals, although a rapidly growing number work in nursing homes and other institutions that provide facilities for long-term care and recuperation.

Training, Other Qualifications, and Advancement

Although some employers prefer high school graduates, many, such as

Over 1 million persons worked as nursing aides, orderlies, and attendants in 1976.

Veterans Administration hospitals, do not require a high school diploma. Employers often accept applicants who are 17 or 18 years of age. Others—particularly nursing homes and mental hospitals—prefer to hire more mature persons who are at least in their mid-twenties.

Nursing aides generally are trained after they are hired. Some institutions combine on-the-job training, under the close supervision of registered or licensed practical nurses, with classroom instruction. Trainees learn to take and record temperatures, bathe patients, change linens on beds that are occupied by patients, and move and lift patients. Training may last several days or a few months, depending on the policies of the hospital or other institution, the complexity of the duties, and the aide's aptitude for the work.

Courses in home nursing and first aid, offered by many public school systems and other community agencies, provide a useful background of knowledge for the work. Volunteer work and temporary summer jobs in hospitals and similar institutions also are helpful. Applicants should be healthy, tactful, patient, understanding, emotionally stable, and dependable. Nursing aides, as other health workers, should have a genuine desire to help people, be able to work as part of a team, and be willing to perform repetitive, routine tasks.

Opportunities for promotions are limited without further training. Some acquire specialized training to prepare for better paying positions such as hospital operating room technician.

To become licensed practical nurses, nursing aides must complete the year of specialized training required for licensing. Some in-service programs allow nursing aides to get this training while they continue to work part time.

Employment Outlook

Employment of nursing aides is expected to increase faster than the average for all occupations through the mid-1980's. In addition to those needed because of occupational growth, many thousands of nursing aides will be needed each year to replace workers who die, retire, or leave the occupation for other reasons.

Although most jobs for nursing aides and orderlies currently are in hospitals, most new openings will be in nursing homes, convalescent homes, and other long-term care facilities. Major reasons for expected occupational growth are the increasing need for medical care of a growing population, including a larger proportion of elderly people, and the increasing ability of people to pay for health care, largely as a result of the growth in public and private health insurance.

Earnings and Working Conditions

Nursing aides, orderlies, and attendants earned salaries that were below the average for all nonsupervisory workers in private industry, except farming. Nursing aides employed full time by nursing homes and related facilities earned considerably less than those in hospitals. Depending on the experience of the applicant, starting salaries of nursing aides in Veterans Administration hospitals ranged from $125 to $140 a week in 1977. The average salary earned by nursing aides employed by the Federal Government was $185 a week in 1977.

With few exceptions, the scheduled workweek of attendants in hospitals is 40 hours or less. Because nursing care must be available to patients on a 24-hour-a-day basis, scheduled hours include nightwork and work on weekends and holidays.

Attendants in hospitals and similar institutions generally receive paid vacations which, after 1 year of service, may be a week or more in length. Paid holidays and sick leave, hospital and medical benefits, shift differentials, and pension plans also are available to many hospital employees.

Sources of Additional Information

Information about employment may be obtained from local hospitals and nursing homes. Additional information about the work of nursing aides, orderlies, and attendants is available from:

Division of Careers and Recruitment, American Hospital Association, 840 N. Lake Shore Dr., Chicago, Ill. 60611.

THERAPY AND REHABILITATION OCCUPATIONS

Persons disabled by accident, burns, strokes, and disease, as well as the emotionally disturbed, all benefit from the care given by therapy and rehabilitation workers. After an accident or serious illness leaves a victim fully or partially disabled, *physical therapists*, and *physical therapist assistants* and *aides* work to restore the patient to the fullest possible level of activity. *Occupational therapists* and *occupational therapy assistants and aides* guide the disabled further along the road to realizing a satisfying and productive life. They teach disabled and emotionally disturbed clients skills and crafts that help build coordination and self-confidence, and, in many cases, prepare them to return to work. They also help the elderly in nursing homes by involving them in interesting and absorbing hobbies. Also described in this section are *speech pathologists* and *audiologists*, who specialize in helping those with speech and hearing problems to overcome their handicaps.

Anyone considering work in one of these fields should have a genuine concern for the physical and emotional well-being of others. Emotional stability and the ability to maintain a pleasant disposition and a positive outlook also are important, because these workers often deal with clients affected by severe handicaps.

Other occupations also provide opportunity for work with the disabled and handicapped. Rehabilitation counselors give personal and vocational guidance to the physically, mentally, or socially handicapped. Employment counselors work with the disabled as well as the able-bodied in career planning and job adjustment. Both occupations are described elsewhere in the *Handbook*.

OCCUPATIONAL THERAPISTS

(D.O.T. 079.128)

Nature of the Work

Occupational therapists plan and direct educational, vocational, and recreational activities designed to help mentally and physically disabled patients become self-sufficient. They evaluate the capacities and skills of clients, set goals, and plan a therapy program together with the client and members of a medical team which may include physicians, physical therapists, vocational counselors, nurses, social workers, and other specialists.

About two therapists out of five work with emotionally handicapped patients, and the rest work with physically disabled persons. These clients represent all age groups and degrees of disability. Patients participate in occupational therapy to determine the extent of abilities and limitations; to regain physical, mental, or emotional stability; to relearn daily routines such as eating, dressing, writing, and using a telephone; and, eventually, to prepare for employment.

Occupational therapists teach manual and creative skills such as weaving and leather working, and business and industrial skills such as typing and the use of power tools. These skills are taught to restore mobility and coordination and to help the patient regain physical and emotional stability. Therapists also plan and direct games and other activities, especially for children. They may design and make special equipment or

Occupational therapists help handicapped people prepare for employment.

splints to help disabled patients.

Besides working with patients, occupational therapists supervise student therapists, occupational therapy assistants, volunteers, and auxiliary nursing workers. The chief occupational therapist in hospitals may teach medical and nursing students the principles of occupational therapy. Many therapists supervise occupational therapy departments, coordinate patient activities, or are consultants to local and State health departments and mental health agencies. Some teach in colleges and universities.

Places of Employment

About 10,600 occupational therapists were employed in 1976. About 4 out of 10 occupational therapists work in hospitals. Rehabilitation centers, nursing homes, schools, outpatient clinics, community mental health centers, and research centers employ most of the others. Some work in special sanitariums or camps for handicapped children, others in State health departments. Still others work in home-care programs for patients unable to attend clinics or workshops. Some are members of the Armed Forces.

Training, Other Qualifications, and Advancement

A degree or certification in occupational therapy is required to enter the profession. In 1976, 49 colleges and universities offered programs in occupational therapy which were accredited by the American Medical Association and the American Occupational Therapy Association. All of these schools offer bachelor's degree programs. Some have 2-year programs and accept students who have completed 2 years of college. Some also offer shorter programs, leading to a certificate or a master's degree in occupational therapy for students who have a bachelor's degree in another field. A graduate degree often is required for teaching, research, or administrative work.

Course work in occupational therapy programs includes physical, biological, and behavioral sciences and the application of occupational therapy theory and skills. These programs also require students to work for 6 to 9 months in hospitals or health agencies to gain experience in clinical practice. Graduates of accredited educational programs are eligible to take the American Occupational Therapy Association certification examination to become a registered occupational therapist (OTR). Occupational therapy assistants who are certified by the association (COTA's) and have 4 years of approved work experience also are eligible to take the examination to become registered occupational therapists. Those COTA's considering this path of entry to the occupation should contact the Director of Certification of the American Occupational Therapy Association to identify the types of experience required to qualify for the examination and to determine the availability of suitable work settings.

Entry to educational programs is keenly competitive and applicants are screened carefully for previous academic performance to select those most likely to complete their studies successfully. Persons considering this profession, therefore, should have above average academic performance and consistent grades of "B" or better in science courses, including biology and chemistry. College students who consider transferring from another academic discipline to an occupational therapy program in their sophomore or junior year need superior grades because competition for entrance to programs is more intense after the freshman year.

Personal qualifications needed in the profession include a sympathetic but objective approach to illness and disability, maturity, patience, imagination, manual skills, and the ability to teach. In addition to biology and chemistry, high school students interested in careers as occupational therapists are advised to take courses in health, crafts, and the social sciences.

Newly graduated occupational therapists generally begin as staff therapists. Advancement is chiefly to supervisory or administrative positions; some therapists pursue advanced education and teach or do research.

Employment Outlook

Employment in this occupation is expected to grow much faster than the average for all occupations due to public interest in the rehabilitation of disabled persons and the success of established occupational therapy programs. Many therapists will be needed to staff hospital rehabilitation departments, community health centers, extended care facilities, psychiatric centers, schools for children with developmental and learning disabilities, and community home health programs.

However, the increasing number of graduates from occupational therapy programs may exceed the number of openings that will occur each year due to growth in the occupation and replacement of those who will die or retire. As a result, new graduates may face competition in some geographic areas through the mid-1980's.

Earnings and Working Conditions

Beginning salaries for new graduates of occupational therapy programs working in hospitals averaged about $12,000 a year in 1976, according to a national survey conducted by the University of Texas Medical School. Some experienced therapists earned as much as $17,000, and some administrators as much as $25,000 to $30,000. In 1976, the average salary of experienced occupational therapists was 1 1/2 times the average earnings for all nonsupervisory workers in private industry, except farming.

In 1977, beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $10,370 a year. The average salary paid occupational therapists working for the VA was about $16,000 at that time.

Many part-time positions are available for occupational therapists. Many therapists work for more than one employer and must travel between job locations.

Sources of Additional Information

For more information on occupational therapy as a career, write to:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

Those COTA's interested in qualifying for the examination to become a registered occupational therapist (OTR) through acquired work experience should contact the Director of Certification at the above address.

OCCUPATIONAL THERAPY ASSISTANTS & AIDES

(D.O.T. 079.368)

Nature of the Work

Occupational therapy assistants work under the supervision of professional occupational therapists to help rehabilitate patients who are physically and mentally disabled. They help plan and implement programs of educational, vocational, and recreational activities that strengthen patients' muscle power, increase motion and coordination, and develop self-sufficiency in overcoming disabilities.

Occupational therapy assistants teach clients self-care skills such as dressing, eating, and shaving; work-related skills such as the use of power tools; and recreational and social activities such as games, dramatics, and gardening. They also may teach creative skills such as woodworking, ceramics, and graphic arts.

Assistants must be able to teach a broad range of skills because of the wide variety of patients. They may work either with groups or with individual patients. When treating patients with diseases, assistants usually work under the supervision of professional occupational therapists. In other situations, such as organizing crafts projects for handicapped persons living in institutions, they may function independently, with only periodic consultation with professionals.

Occupational therapy aides order supplies, prepare work materials, and help maintain tools and equipment.

Occupational therapy assistants must be able to teach a broad range of skills.

They also may keep records on patients, prepare clinical notes, and perform other clerical duties.

Some small occupational therapy departments may consist only of a therapist and one other worker. In these cases, the assistant or aide may assume most of the duties of an occupational therapist, within the limits of his or her training.

Places of Employment

About 8,900 people worked as occupational therapy assistants and aides in 1976. Almost half of all occupational therapy assistants work in hospitals. Others work in nursing homes, schools for handicapped children and the mentally retarded, rehabilitation and day care centers, special workshops, and outpatient clinics. A small number are members of the Armed Forces.

Occupational therapy aides work in the same locations as assistants, but they generally are most often employed in hospitals.

Training, Other Qualifications, and Advancement

Two types of educational programs prepare occupational therapy assistants: junior or community college programs that award an associate degree upon completion and vocational or technical programs of about 1 year's duration. In 1976, 42 schools offered educational programs approved by the American Occupational Therapy Association. Most of these are 2-year college programs leading to an associate degree.

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About one-third are 1-year vocational and technical school programs. In addition, the Armed Forces operate a school to train occupational therapy assistants.

Graduates of these programs who successfully complete the written national proficiency examination are certified by the American Occupational Therapy Association and receive the title Certified Occupational Therapy Assistant (COTA). In 1976, about 2,640 employed occupational therapy assistants were COTA's.

Approved programs combine classroom instruction with at least 2 months of supervised practical experience. Courses include the history and philosophy of occupational therapy, occupational therapy theory and skills, anatomy and physiology of the human body, the effect of illness and injury on patients, and human development. Students also practice skills and crafts they later will teach to patients.

Applicants for training programs must be high school graduates or the equivalent. Among the subjects recommended for high school students interested in the occupational therapy field are health, biology, typing, and the social sciences. Preference sometimes is given to applicants who have taken courses in science and crafts and have previous work experience in a health care setting.

Occupational therapy aides train on the job in hospitals and other health care facilities. The length and content of their training varies depending on the level of difficulty of the duties that aides are expected to perform.

Occupational therapy assistants and aides should like people, have good physical and mental health, and be able to establish and maintain effective interpersonal relationships. They also should have manual skills since they must teach clients how to use tools and materials.

Occupational therapy assistants and aides who work in large health facilities begin with routine tasks and may advance to more responsible ones as they gain experience. A COTA with 4 years of approved work experience may take the examination to become a registered occupational therapist (OTR) without completing the remaining 2 years of study for a bachelor's degree in occupational therapy. Those COTA's considering this path of entry to the occupational therapy profession should contact the Director of Certification of the American Occupational Therapy Association to identify the types of experience required to qualify for the examination.

Employment Outlook

The employment of occupational therapy assistants and aides is expected to grow much faster than the average for all occupations, due to public interest in the rehabilitation of disabled people. All types of health care institutions, especially nursing homes and community health centers, will need more occupational therapy assistants through the mid-1980's.

Employment opportunities for occupational therapy assistants are expected to be very good through the mid-1980's, particularly for graduates of approved programs. Many openings will be created each year by growth in the occupation and even more will occur as workers die, retire, or leave the field for other reasons.

The number of educational programs for occupational therapy assistants is expected to increase, with the result that assistants in some geographical areas may face competition for jobs. On a national basis, however, the supply of graduates is likely to fall short of requirements.

Earnings and Working Conditions

In 1976, annual salaries generally ranged from $7,500 to $9,000 for inexperienced assistants. Experienced occupational therapy assistants earned between $8,500 and $12,000 a year, according to the limited information available. Those who completed an approved program generally earned higher starting salaries than beginners without any training. Occupational therapy assistants working for the Veterans Administration earned starting salaries of $7,408 annually in 1977, and the average of salaries paid to all occupational therapy assistants with the Federal Government was about $11,500 a year.

Occupational therapy aides earned beginning salaries of about $6,200 a year in 1976, according to the limited information available.

Occupational therapy assistants and aides occasionally may work evenings, weekends, and part time.

Sources of Additional Information

For information about work opportunities and programs offering training for occupational therapy assistants, contact:

American Occupational Therapy Association, 6000 Executive Blvd., Rockville, Md. 20852.

Those COTA's interested in qualifying for the examination to become a registered occupational therapist (OTR) through acquired work experience should contact the Director of Certification, American Occupational Therapy Association, at the above address.

PHYSICAL THERAPISTS

(D.O.T. 079.378)

Nature of the Work

Physical therapists help persons with muscle, nerve, joint, and bone diseases or injuries to overcome their disabilities. Their patients include accident victims, crippled children, and disabled older persons. Physical therapists perform and interpret tests and measurements for muscle strength, motor development, functional capacity, and respiratory and circulatory efficiency to develop programs for treatment in cooperation with the patient's physician. They evaluate the effectiveness of the treatment and discuss the patients' progress with physicians, psychologists, occupational therapists, and other specialists. When advisable, physical therapists revise the therapeutic procedures and treatments. They help disabled persons to accept their physical handicaps and adjust to them. They show members of the

Physical therapists develop programs for treatment of disabled persons of all ages.

patients' families how to continue treatments at home.

Therapeutic procedures include exercises for increasing strength, endurance, coordination, and range of motion; electrical stimuli to activate paralyzed muscles; instruction in carrying out everyday activities and in the use of helping devices; and the application of massage, heat and cold, light, water, or electricity to relieve pain or improve the condition of muscles and skin.

Most physical therapists provide direct care to patients as staff members, supervisors, or self-employed practitioners. Physical therapists usually perform their own evaluations of patients; in large hospitals and nursing homes, however, the director or assistant director of the physical therapy department may handle this work, which requires extensive training and experience. Therapists may treat patients with a wide variety of problems, or they may specialize in pediatrics, geriatrics, amputations, arthritis, or paralysis. Others teach or are consultants.

Places of Employment

About 25,000 persons worked as licensed physical therapists in 1976. The largest number work in hospitals. Nursing homes employ a growing number of physical therapists, and also contract for the services of self-employed therapists. Others work in rehabilitation centers or schools for crippled children. Some who work for public health agencies treat chronically sick patients in their own homes. Still others work in physicians' offices or clinics, teach in physical therapy educational programs, or work for research organizations. A few serve as consultants in government and voluntary agencies or are members of the Armed Forces.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require a license to practice physical therapy. Applicants for a license must have a degree or certificate from an accredited physical therapy educational program and to qualify must pass a State board examination. Applicants may prepare for State board examinations in physical therapy through one of three types of programs, depending upon previous academic study. High school graduates can earn a 4-year bachelor's degree in physical therapy at a college or university. Students who already hold a bachelor's degree in another field, such as biology or physical education, can earn a second bachelor's degree or a certification in physical therapy through special programs lasting 12 to 16 months. These applicants also have the option of working for a master's degree in physical therapy.

In 1976, 11 certificate programs, 76 bachelor's degree programs and 5 master's degree programs were accredited by the American Physical Therapy Association and the American Medical Association to provide entry level training. There were also 17 other master's degree programs that provided advanced training to those already in the field. One of the certificate programs is sponsored jointly by the U.S. Army and Baylor University; graduates are commissioned as officers in the Army.

The physical therapy curriculum includes science courses such as anatomy, physiology, neuroanatomy, and neurophysiology; it also includes specialized courses such as biomechanics of motion, human growth and development, and manifestations of disease and trauma. Besides receiving classroom instruction, students get supervised clinical experience administering physical therapy

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to patients in a hospital or treatment center.

Competition for entry to all physical therapy programs is keen. Institutions offering a physical therapy program each year receive many more applications than the number of existing places. Consequently, students seriously interested in attending a physical therapy program must attain superior grades in their earlier studies, especially in science courses.

Personal traits that physical therapists need include patience, tact, resourcefulness, and emotional stability to help patients and their families understand the treatments and adjust to their handicaps. Physical therapists also should have manual dexterity and physical stamina. Many persons who want to determine whether they have the personal qualities needed for this occupation volunteer for summer or part-time work in the physical therapy department of a hospital or clinic. High school courses that are useful include health, biology, social science, mathematics, and physical education.

A graduate degree combined with clinical experience increases opportunities for advancement, especially to teaching, research, and administrative positions.

Employment Outlook

Employment of physical therapists is expected to grow faster than the average for all occupations through the mid-1980's because of increased public recognition of the importance of rehabilitation. As programs to aid crippled children and other rehabilitation activities expand, and as growth takes place in nursing homes and other facilities for the elderly, many new positions for physical therapists are likely to be created. Many part-time positions should continue to be available.

However, the rapidly growing number of new graduates is expected to exceed the number of openings that will occur each year due to growth in the occupation and replacement of those who will die or retire. As a result, new graduates are expected to face some competition through the mid-1980's. Employment opportunities will be best in surburban and rural areas.

Earnings and Working Conditions

Starting salaries for new physical therapy graduates averaged about $11,200 a year in 1976, according to a national survey conducted by the University of Texas Medical School. Earnings of experienced physical therapists averaged about $14,000, about one and a half times as much as average earnings for all nonsupervisory workers in private industry, except farming.

Beginning therapists employed by the Veterans Administration (VA) earned starting salaries of $10,473 a year in 1977. The average salary paid therapists employed by the VA in 1977 was $15,700 annually; supervisory therapists may earn over $20,000.

Sources of Additional Information

Additional information on a career as a physical therapist and a list of accredited educational programs in physical therapy are available from:

American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

PHYSICAL THERAPIST ASSISTANTS AND AIDES

(D.O.T. 355.878)

Nature of the Work

Physical therapist assistants and aides work under the supervision of professional physical therapists to rehabilitate disabled persons so that they may again lead useful and productive lives. They work to restore physical functions and prevent disability from injury or illness.

Assistants help physical therapists test patients to determine the extent of their capabilities and the best treatment for them. Using special therapy equipment, they apply heat, cold, light, ultra sound, and massage, and report to their supervisors on

Aide helps patient do therapeutic exercises.

how well the patient is responding to treatment. Assistants help patients perform therapeutic exercises to build strength and increase motion as well as everyday activities such as walking and climbing stairs. They also help the physical therapist to instruct patients on how to use artificial limbs, braces, and splints.

Physical therapist aides help patients prepare for treatment, and may remove and replace devices such as braces, splints, and slings and transport patients to and from treatment areas. They may help assistants or therapists by supporting patients during treatment. Aides care for and assemble treatment equipment. They also make appointments, act as receptionists, and perform other clerical duties.

Some small health care institutions, such as small hospitals or nursing homes, employ only one person besides the therapist in the physical therapy department. In this case, the assistant or aide may assume most of the duties of the therapist, within the limits of his or her training.

Places of Employment

About 12,500 persons worked as physical therapist assistants and aides in 1976. Most work in physical therapy departments of general and specialized hospitals. Others work in physicians' or physical therapists' offices and clinics, rehabilitation centers, or nursing homes for the chronically ill and elderly. Some community and government health agencies, schools for crippled children, and facilities for the mentally retarded also employ physical therapist assistants and aides. A small number are members of the Armed Forces.

Training, Other Qualifications, and Advancement

Training requirements for physical therapist assistants are not uniform throughout the country. In 19 States, assistants are licensed. They must be graduates of approved 2-year associate degree programs and pass a written proficiency examination. A few of these States have a "grandfather" clause that allows the educational requirement to be waived for those who learned their skills before associate degree programs became available. In States not requiring a license, physical therapy aides can advance to assistants by acquiring the necessary knowledge and skills on the job, although employers often prefer graduates of approved programs.

There were 37 approved programs to train physical therapist assistants in 1976. Most were in junior or community colleges, and all led to an associate degree. Courses include history and philosophy of rehabilitation, human growth and development, anatomy, physiology, and psychology. Studies also cover physical therapist assistant procedures including massage, therapeutic exercises, and heat and cold therapy. Supervised clinical experience also is a requirement of physical therapist assistant programs. The Armed Forces operate schools to train physical therapist assistants, but this training does not satisfy academic requirements for State licensure and no degree is awarded to graduates.

Physical therapist aides train on the job in hospitals and other health care facilities. The length and content of these training programs vary widely, depending on the level of difficulty of duties that aides are expected to perform, the particular services required by patients in the program, and the amount of time professional therapists spend in teaching trainees. Applicants admitted to physical therapist aide training programs generally must be high school graduates or the equivalent. Employers usually prefer that aides have previous hospital experience as nursing aides.

High school courses that are helpful to physical therapist assistants and aides are health, biology, psychology, physical education, mathematics, and typing.

Physical therapist assistants and aides need good physical health. They also need good manual dexterity to adjust equipment, body coordination to assist in positioning patients, and an interest in assisting the physically handicapped. Emotional stability is important because assistants and aides must maintain a positive, bright outlook while helping patients with very difficult handicaps. Patience and the ability to recognize and appreciate slight improvements also are helpful.

As physical therapist assistants and aides gain experience, they may advance to more responsible duties with corresponding pay increases. Some aides may become physical therapy assistants on the basis of acquired job experience. The opportunities for aides to advance in this way are best in areas where associate degree programs for physical therapist assistants are unavailable.

Physical therapist assistants with an associate degree from an approved program sometimes advance to physical therapists by earning the bachelor's degree in physical therapy. A student thinking about this option should arrange his or her associate degree curriculum carefully to correspond to the undergraduate requirements of the bachelor's degree program under consideration.

Employment Outlook

Job opportunities for physical therapist assistants and aides who are graduates of approved programs are expected to be excellent through the mid-1980's. In communities where there are large classes in physical therapist assistant programs, some graduates may find it necessary to move to other locations where no associate degree programs are available. For the Nation as a whole, however, the number of openings for physical therapist assistants caused by growth and replacement needs are expected to far exceed the number of graduates from these programs.

The number of physical therapist assistants and aides is expected to increase faster than the average for all occupations as the demand for professional physical therapists grows. Overall demand in the field stems from increased public awareness of the importance of rehabilitation and the growing number of nursing homes which provide therapeutic services to the elderly. Expanded physical therapy services planned by hospitals, nursing homes, schools for

crippled children, facilities for mentally retarded, and other health and rehabilitation centers are expected to further increase the need for physical therapist assistants and aides.

Earnings and Working Conditions

In 1976, weekly salaries averaged about $116 for beginning physical therapist aides and about $170 for those with experience, according to the limited information available. Physical therapist assistants received higher salaries than aides, beginning at about $175 a week. Experienced physical therapist assistants earned as much as $325 weekly. Physical therapist assistants working for the Veterans Administration (VA) earned starting salaries of $115 a week in 1977, and the average of salaries paid to all physical therapist assistants with the VA was about $214 weekly.

Sources of Additional Information

Information on a career as a physical therapist assistant or aide and on programs offering training for physical therapist assistant is available from:

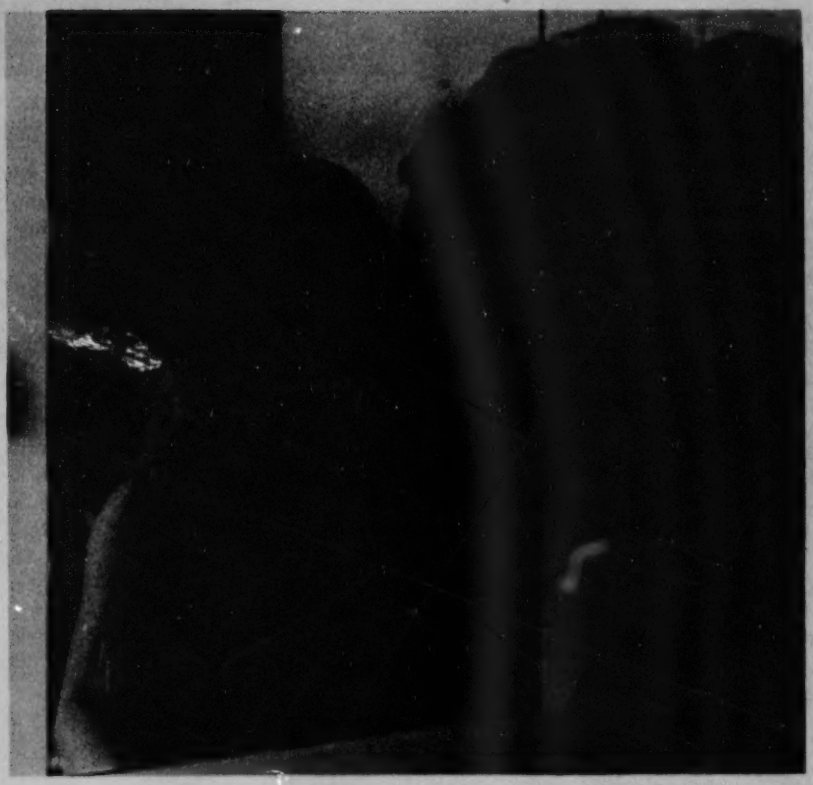
The American Physical Therapy Association, 1156 15th St. NW., Washington, D.C. 20005.

SPEECH PATHOLOGISTS AND AUDIOLOGISTS

(D.O.T. 079.108)

Nature of the Work

About one out of ten Americans is unable to speak or hear clearly. Children who have trouble speaking or hearing cannot participate fully with other children in play or in normal classroom activities. Adults having speech or hearing impairments often have problems in job adjustment. Speech pathologists and audiologists provide direct services to these people by evaluating their speech or hearing disorders and then providing treatment.



Speech pathologists and audiologists help people overcome speech and hearing disorders.

The speech pathologist works with children and adults who have speech, language, and voice disorders resulting from causes such as total or partial hearing loss, brain injury, cleft palate, mental retardation, emotional problems, or foreign dialect. The audiologist primarily assesses and treats hearing problems. Speech and hearing, however, are so interrelated that, to be competent in one of these fields, one must be familiar with both.

The duties of speech pathologists and audiologists vary with education, experience, and place of employment. In clinics, either in schools or other locations, they use diagnostic procedures to identify and evaluate speech and hearing disorders. Then, in cooperation with physicians, psychologists, physical therapists, and counselors, they develop and implement an organized program of therapy. Some speech pathologists and audiologists conduct research such as investigating the causes of communicative disorders and improving methods for clinical services. Others supervise clinical activities.

Speech pathologists and audiologists in colleges and universities teach courses in the principles of communication, communication disorders, and clinical techniques; participate in educational programs for physicians, nurses, and teachers; and work in university clinics and research centers. Although most speech pathologists and audiologists do some administrative work, directors of speech and hearing clinics and coordinators of speech and hearing in schools, health departments, or government agencies may be totally involved in administration.

Places of Employment

Over 38,000 persons worked as speech pathologists and audiologists

in 1976. Over one-half worked in public schools. Colleges and universities employed many in classrooms, clinics, and research centers. The rest worked in hospitals, speech and hearing centers, government agencies, industry, and private practice.

Training, Other Qualifications, and Advancement

An increasing number of States require a master's degree or its equivalent for speech pathologists and audiologists. In addition, many Federal programs, such as Medicare and Medicaid, require participating speech pathologists and audiologists to have a master's degree. Some States require a teaching certificate to work in the public schools. In 29 States, those offering speech pathology and audiology services outside of schools must be licensed. Licensure requirements vary among the States.

Undergraduate courses in speech pathology and audiology programs include anatomy, biology, physiology, physics, sociology, linguistics, semantics, and phonetics. Courses in speech and hearing as well as in child psychology and psychology of the exceptional child also are helpful. This training usually is available at colleges that offer a broad liberal arts program.

In early 1977, about 228 colleges and universities offered graduate education in speech pathology and audiology. Courses at the graduate level include advanced anatomy and physiology of the areas involved in hearing and speech; acoustics; psychological aspects of communication; and analysis of speech production, language abilities, and auditory processes. Graduate students also take courses in the evaluation and remediation of speech, language, and hearing disorders. All students at the graduate level receive supervised clinical training with clients having communicative disorders.

A limited number of scholarships, fellowships, assistantships, and traineeships are available in this field. Teaching and training grants to colleges and universities that have programs in speech and hearing are given by a number of agencies of the U.S. Department of Health, Education, and Welfare—the Rehabilitation Services Administration, the Maternal and Child Health Service, the Office of Education, and the National Institutes of Health. In addition, some Federal agencies distribute money to colleges to aid graduate students in speech and hearing programs. A large number of private organizations and foundations also provide financial assistance for education in this field.

Meeting the American Speech and Hearing Association's (ASHA) requirements for a Certificate of Clinical Competence usually is necessary in order to advance professionally and to earn a higher salary. To earn the CCC, a person must have a master's degree or its equivalent and complete a one-year internship approved by the Association. Passing a national written examination also is required.

Speech pathologists and audiologists should be able to approach problems objectively and have a concern for the needs of others. They also should have considerable patience, because a client's progress often is slow. A person who desires a career in speech pathology and audiology should be able to accept responsibility, work independently, and direct others. The ability to work with detail is important. Speech pathologists and audiologists receive satisfaction from seeing clients' speech or hearing improve as a result of their work.

Employment Outlook

The employment of speech pathologists and audiologists is expected to increase faster than the average for all other occupations through the mid-1980's. However, temporary reductions in government spending on speech and hearing programs may decrease the number of new positions available at any one time. Although some jobs will be available for those having only a bachelor's degree, the increasing emphasis placed on the master's degree by State governments, school systems, and Federal agencies will limit opportunities at the bachelor's degree level.

While employment opportunities for those with a master's degree generally should be favorable, the large number of graduates entering this field may cause some competition. Many openings will occur outside of the large metropolitan areas and some graduates will have to relocate in order to find employment. Competition for teaching positions in colleges and universities will be very strong throughout the period.

Population growth, which will increase the number of persons having speech and hearing problems, is one of the factors underlying the expected expansion in employment of speech pathologists and audiologists through the mid-1980's. In addition, there is a trend toward earlier recognition and treatment of hearing and language problems in children. Many school-age children, thought to have learning disabilities, actually have language or hearing disorders which speech pathologists and audiologists can treat.

Other factors expected to increase demand for speech pathologists and audiologists are expansion in expenditures for medical research and the growing public interest in speech and hearing disorders. State and Federal laws now require school systems to provide equal educational services for handicapped children, and Medicare and Medicaid programs have expanded their coverage of speech and hearing services.

Earnings and Working Conditions

In 1977, the annual starting salary in the Federal Government for speech pathologists and audiologists with a master's degree was $14,097. Those having a doctoral degree were eligible to start at $17,056. The average salary of all speech pathologists and audiologists working for the Federal Government was $21,804.

Salaries of speech pathologists outside of government tend to be higher in areas having large urban populations. Many speech pathologists and audiologists, particularly those in colleges and universities, supplement their incomes by acting as consul-

tants, engaging in research projects, and writing books and articles.

Many speech pathologists and audiologists work over 40 hours a week. Almost all receive fringe benefits such as paid vacations, sick leave, and retirement programs.

Sources of Additional Information

State departments of education can supply information on certification requirements for those who wish to work in public schools.

A list of college and university programs and a booklet on student financial aid as well as general career information are available from:

American Speech and Hearing Association, 9030 Old Georgetown Rd., Washington, D.C. 20014.

OTHER HEALTH OCCUPATIONS

DIETITIANS

(D.O.T. 077.081 through .168)

Nature of the Work

Dietitians plan nutritious and appetizing meals to help people maintain or recover good health. They also supervise the food service personnel who prepare and serve the meals, manage dietetic purchasing and accounting, and give advice on good eating habits. Clinical dietitians form the largest group in this occupation; the others are administrative, teaching, and research dietitians. Nutritionists also are included in this field.

Administrative dietitians apply the principles of nutrition and sound management to large-scale meal planning and preparation, such as that done in hospitals, universities, schools, and other institutions. They supervise the planning, preparation, and service of meals; select, train, and direct food service supervisors and workers; budget for and purchase food, equipment, and supplies; enforce sanitary and safety regulations; and prepare records and reports. Dietitians who are directors of a dietetic department also decide on departmental policy; coordinate dietetic service with the activities of other departments; and are responsible for the dietetic department budget, which in large organizations may amount to millions of dollars annually.

Clinical dietitians, sometimes called therapeutic dietitians, plan diets and supervise the service of meals to meet the nutritional needs of patients in hospitals, nursing homes, or clinics. Among their duties, clinical dietitians confer with doctors and other members of the health care team about patients' nutritional care, instruct patients and their families on the requirements and importance of their diets, and suggest ways to keep on these diets after leaving the hospital or clinic. In a small institution, one person may be both the administrative and clinical dietitian.

Research dietitians conduct, evaluate, and interpret research to improve the nutrition of both healthy and sick people. This research may be in nutrition science and education, food management, or food service systems and equipment. They may conduct studies of how the body uses food. Research projects may investigate the nutritional needs of the aging, or persons with a chronic disease, or space travelers. Research dietitians usually are employed in medical centers or education facilities, but also may work in community health programs. (See statement on food scientists elsewhere in the *Handbook*.)

Dietetic educators teach dietetics to dietetic, medical, dental, and nursing students and to interns, residents, and other members of the health care team. They usually work in medical and educational institutions.

Clinical dietitians plan meals for patients in hospitals, nursing homes, or clinics.

Nutritionists may counsel individuals and groups on sound nutrition practices to maintain and improve health or they may engage in teaching and research. This work covers such areas as special diets, meal planning and preparation, and food budgeting and purchasing. Nutritionists in community health may be responsible for the nutrition components of preventive health and medical care services. This includes planning, developing, coordinating, and administering a nutrition program or a nutrition component as an integral part of a community health program. Nutritionists work in such diverse areas as food industries, educational and health facilities, and agricultural and welfare agencies, both public and private.

An increasing number of dietitians work as consultants to hospitals and to health-related facilities. Others act as consultants to commercial enterprises, including food processors and equipment manufacturers.

Places of Employment

About 45,000 persons worked as dietitians in 1976. More than one-half work in hospitals, nursing homes, and clinics, including about 1,100 in the Veterans Administration and the U.S. Public Health Service. Colleges, universities, and school systems employ a large number of dietitians as teachers or in food service systems. Most of the rest work for health-related agencies, restaurants or cafeterias, and large companies that provide food service for their employees. Some dietitians are commissioned officers in the Armed Forces.

Training, Other Qualifications, and Advancement

A bachelor's degree, preferably with a major in foods and nutrition or institution management, is the basic educational requirement for dietitians. This degree can be earned in about 240 colleges and universities, usually in departments of home economics. College courses usually re-

quired are in food and nutrition, institution management, chemistry, bacteriology, physiology, and related courses such as mathematics, data processing, psychology, sociology, and economics.

For a dietitian to qualify for professional recognition, the American Dietetic Association (ADA) recommends the completion after graduation of an approved dietetic internship or an approved individual traineeship program. The internship lasts 6 to 12 months and the traineeship program 1 to 2 years. Both programs combine clinical experience under a qualified dietitian with some classroom work. In 1976, 68 internship programs were approved by the American Dietetic Association. A growing number of coordinated undergraduate programs, located in schools of medicine and in allied health and home economics departments of both colleges and universities, enable students to complete both the requirements for a bachelor's degree and the clinical experience requirement in 4 years. The ADA approves coordinated undergraduate programs.

Persons meeting the qualifications established by the ADA's Commission on Dietetic Registration can become Registered Dietitians (R.D.'s). Registration with the ADA is acknowledgement of a dietitian's competence.

Experienced dietitians may advance to assistant or associate director or director of a dietetic department. Advancement to higher level positions in teaching and research usually requires graduate education; public health nutritionists must earn a graduate degree in this field. Graduate study in institutional or business administration is valuable to those interested in administrative dietetics.

Persons who plan to become dietitians should have organizational and administrative ability, as well as high scientific aptitude, and should be able to work well with a variety of people. Among the courses recommended for high school students interested in careers as dietitians are home economics, business administration, biology, health, mathematics, and chemistry.

Employment Outlook

Employment opportunities for qualified dietitians on both a full-time and part-time basis are expected to be good through the mid-1980's. In recent years, employers have used dietetic assistants trained in vocational and technical schools and dietetic technicians educated in junior colleges to help meet the demand for dietetic services. Because this situation is likely to persist, employment opportunities also should continue to be favorable for graduates of these programs.

Employment of dietitians is expected to grow about as fast as the average for all occupations through the mid-1980's to meet the food management needs of hospitals and extended care facilities, industrial plants, and restaurants. Dietitians also will be needed to staff community health programs and to conduct research in food and nutrition. In addition to new dietitians needed because of occupational growth, many others will be required each year to replace those who die, retire, or leave the profession for other reasons.

Earnings and Working Conditions

Starting salaries of hospital dietitians averaged $11,300 a year in 1976, according to a national survey conducted by the University of Texas Medical Brancn. Experienced dietitians received annual salaries ranging from $13,900 to $25,300, according to the American Dietetic Association. The median salary paid by colleges and universities to dietitians with bachelor's degrees was $13,900 a year in 1976. The median salary for those with bachelor's degrees working in commercial or industrial establishments was $14,400 a year; for those in public and voluntary health agencies, $13,000. For self-employed dietitians with a bachelor's degree, the median salary was over $16,000 a year in 1976.

The entrance salary in the Federal Government for those completing an approved internship was $11,523 in 1977. Beginning dietitians with a master's degree who had completed an internship earned $14,097. In 1977, the Federal Government paid experienced dietitians average salaries of $18,109 a year.

Most dietitians work 40 hours a week; however, dietitians in hospitals may sometimes work on weekends, and those in commercial food service have somewhat irregular hours. Some hospitals provide laundry service in addition to salary. Dietitians usually receive paid vacations, holidays, and health insurance and retirement benefits.

Sources of Additional Information

For information on approved dietetic internship programs, scholarships, employment opportunities, and registration, and a list of colleges providing training for a professional career in dietetics, contact:

The American Dietetic Association, 430 North Michigan Ave., 10th floor, Chicago, Ill. 60611.

The U.S. Civil Service Commission, Washington, D.C. 20415, will send information on the requirements for dietetic interns and dietitians in Federal Government hospitals and for public health nutritionists and dietitians in the Public Health Service, U.S. Department of Health, Education, and Welfare, and in the District of Columbia government programs.

DISPENSING OPTICIANS

(D.O.T. 713.251, and 299.884)

Nature of the Work

About 100 million people in the United States use some form of corrective lenses to improve their vision. Dispensing opticians (also called *ophthalmic dispensers*) receive lens prescriptions from eye doctors (ophthalmologists) or optometrists, determine the size and style of eyeglasses desired by the customer, write work orders for ophthalmic laboratory technicians, and adjust finished glasses to fit the customer. In many States they fit contact lenses.

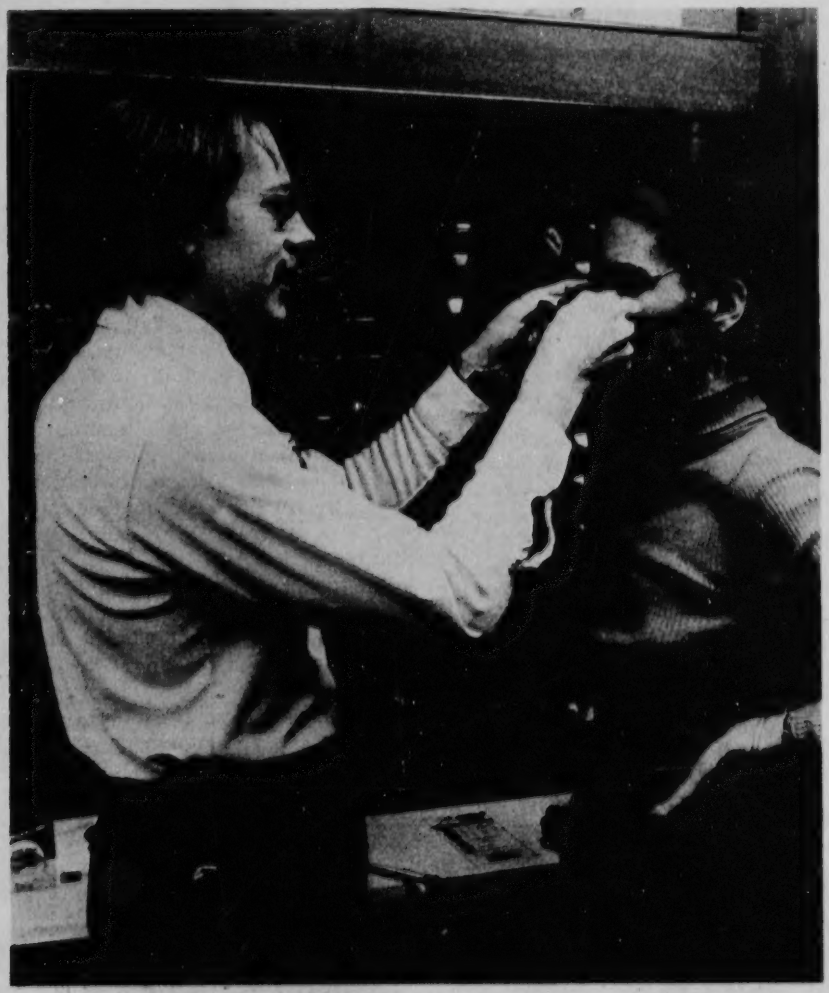
Dispensing opticians determine where lenses should be placed in

relation to the customer's eyes by measuring the distance between the centers of the pupils. They also assist the customer in selecting the proper eyeglass frame by measuring the customer's facial features and showing the various styles and colors of frames.

Dispensing opticians analyze and interpet precriptions and prepare work orders that give ophthalmic laboratory technicians the information they need to properly, grind the lenses, and insert them in a frame. The work orders include lens prescriptions and information on lens size, color, and style. After glasses are made, dispensing opticians use a special instrument to check the power and surface quality of the lenses. Opticians then adjust the frame to the contours of the customer's face and head so that it fits properly and comfortably. Adjustments are made with handtools, such as optical pliers, files, and screwdrivers. A special instrument is used to check the power and surface quality of the lenses.

In fitting contact lenses, dispensing opticians follow ophthalmologists' or optometrists' prescriptions, measure the corneas of customers' eyes and then prepare specifications to be followed by the contact lens manufacturer. Contact lens fitting requires considerably more skill, care, and patience than conventional eyeglass fitting. Dispensing opticians tell customers how to insert, remove, and care for contact lenses during the initial adjustment period, which may last several weeks. The dispensing optician examines the patient's eyes, cornea, lids, and contact lens with special instruments and microscopes at each visit. Ophthalmologists or optometrists recheck the fit, as needed. Opticians may make minor adjustments; lenses are returned to the manufacturer for major changes.

The majority of dispensing opticians are in the general practice of designing and fitting eyeglasses. Some specialize in the fitting of cosmetic shells to cover blemished eyes. Still others specialize in the fitting of prosthesis (artificial eyes). In some shops, they may do lens grinding and finishing and sell other optical goods such as binoculars, magnifying glasses, and nonprescription eyeglasses.



Dispensing optician adjusts finished glasses to fit the customer.

Places of Employment

About 14,500 persons worked as dispensing opticians in 1976. Most dispensing opticians work for retail optical shops or department stores and other retail stores that sell prescription lenses. Many also work for ophthalmologists or optometrists who sell glasses directly to patients. A few work in hospitals and eye clinics and teach in schools of ophthalmic dispensing. Many dispensing opticians own retail optical shops.

Dispensing opticians can be found in every State. However, employment is concentrated in large cities and in populous States.

Training, Other Qualifications, and Advancement

Most dispensing opticians learn their skills on the job. On-the-job training in dispensing work may last several years and usually includes instruction in optical mathematics, optical physics, and the use of precision measuring instruments.

Formal institutional training for the dispensing optician is available for high school graduates. In 1977, 15 schools offered 2-year full-time courses in optical fabricating and dispensing work leading to an associate degree. In addition, large manufacturers of contact lenses offer nondegree courses in lens-fitting that usual-

ly last a few weeks. A small number of opticians learn their trade in the Armed Forces.

High school graduates also can prepare for optical dispensing work through 3- to 4-year formal apprenticeship programs. Apprentices with exceptional ability may complete their training in a shorter period.

Apprentices receive training in optical mathematics and optical physics and in the use of laboratory equipment. In addition to technicial training, apprentices are given an opportunity to work directly with patients in the fitting of both eyeglasses and contact lenses. Trainees also are taught the basics of office management and sales.

Employers prefer applicants for entry jobs as dispensing opticians to be high school graduates who have had courses in the basic sciences. A knowledge of physics, algebra, geometry, and mechanical drawing is particularly valuable. Interest in and ability to do precision work are essential. Because dispensing opticians deal directly with the public, they should be tactful and have pleasant personalities.

In 1976, 19 States had licensing requirements governing dispensing opticians: Alaska, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Kentucky, Massachusetts, Nevada, New Jersey, New York, North Carolina, Rhode Island, South Carolina, Tennessee, Vermont, Virginia, and Washington. To obtain a license, the applicant generally must meet certain minimum standards of education and training, and also must pass either a written or practical examination, or both. For specific requirements, the licensing boards of individual States should be consulted.

Many dispensing opticians go into business for themselves. Others may advance by becoming managers of retail optical stores or becoming sales representatives for wholesalers or manufacturers of eyeglasses or lenses.

Employment Outlook

Employment of dispensing opticians is expected to increase faster than the average for all occupations through the mid-1980's. In addition to the job openings from employment growth, some openings will arise from the need to replace experienced workers who retire, die, or leave the occupation for other reasons. The demand for eyeglasses is expected to increase as a result of increases in population and a greater awareness of the need for eyeglasses. State programs to provide eye care for low-income families, union health insurance plans, and Medicare also will stimulate demand. Moreover, the growing variety of frame styles and colors may encourage individuals to buy more than one pair of glasses.

Employment opportunities will be particularly favorable for dispensing opticians who have associate degrees in opticianry. Opportunities will be best in metropolitan areas because many of the retail optical shops in small communities are operated solely by owners and do not need dispensing opticians.

Earnings and Working Conditions

Hourly wage rates for dispensing opticians ranged from $5 to $8 in 1976 based on information from a small number of union contracts. Dispensing opticians who own their own shops can earn considerably more.

Apprentices start at about 60 percent of the skilled worker's rate and are increased periodically so that upon completion of the apprenticeship program, they receive the beginning rate for experienced workers.

Working conditions are generally pleasant, quiet, and clean. Dispensing opticians in retail shops generally work a 5 1/2- or 6-day week.

Some dispensing opticians are members of unions. The principal union in this field is the International Union of Electrical, Radio and Machine Workers (AFL-CIO).

Sources of Additional Information

A list of schools offering courses for people who wish to become dispensing opticians is available from:

National Academy of Opticianry, 514 Chestnut St., Big Rapids, Mich. 49307.

National Federation of Opticianry Schools, 300 Jay St., Brooklyn, N.Y. 11201.

For general information about the occupation, contact:

International Union of Electrical, Radio and Machine Workers, 1176 16th St. NW., Washington, D.C. 20036.

National Federation of Opticianry Schools 300 Jay St., Brooklyn, N.Y. 11201.

Opticians Association of America, 1250 Connecticut Ave. NW., Washington, D.C. 20036.

HEALTH SERVICES ADMINISTRATORS

(D.O.T. 169.168, 187.118, and 187.168)

Nature of the Work

Medical and health care is provided by organizations that vary from large teaching hospitals to small walk-in clinics. Each of these requires effective management to function properly. Health administrators, under the general supervision of boards of directors or other governing bodies, provide this management.

Administrators coordinate the various functions and activities that make a health organization work. They may do this personally, where the organization is small, or direct a staff of assistant administrators in larger organizations. Health administrators make management decisions on matters such as the need for additional personnel and equipment, current and future space requirements, and the budget.

Some health services administrators, including those who manage hospitals or nursing homes, oversee nursing, food services, and in-service training programs. Assistant administrators usually direct the daily operations of these departments; however, the chief executive keeps informed through formal and informal meetings with the assistants, the medical staff, and others. In addition to these management activities, many health administrators help to carry out fundraising drives and promote public participation in health programs. This phase of the administrator's job often includes speaking before civic

Administrators coordinate the various activities of a health organization.

groups, arranging publicity, and coordinating the activities of the organization with those of government or community agencies.

Places of Employment

About 160,000 persons worked as health services administrators in 1976. Most administrators work in health facilities, including hospitals (which employed about half of all administrators), nursing and personal care homes, and health management firms that provide administrative services to health facilities at a specified contract price.

Some health administrators work for government agencies, including State and local health departments and the U.S. Public Health Service. In addition, the Federal Government hires administrators in Veterans Administration and Armed Forces hospitals and clinics. Others work for voluntary health agencies that conduct research and provide care and treatment for victims of particular diseases or physical impairments.

Training, Other Qualifications, and Advancement

Educational requirements for health services administrators vary according to the position's level of responsibility and the size of the organization. Generally, larger organizations with more complicated administrative structures require higher credentials than smaller ones.

Applicants with master's degrees in health or hospital administration may be hired as associate or assistant administrators in hospitals, while those with master's degrees in public health often find work as program analysts or program representatives in public health departments. Very few master's degree recipients take entry positions in nursing or personal care homes, although many nursing home administrators pursue graduate education while employed.

Bachelor's degree recipients usually begin their careers as administrative assistants or department heads in hospitals, or as assistant administrators in nursing homes. Graduates of 2-year, associate degree programs generally are hired as unit directors or assistant department heads in hospitals, or as assistants to program representatives in public health departments. Some associate degree holders find assistant administrator jobs in small nursing homes.

The Ph. D. degree usually is required for positions in teaching or research, and is an asset for those seeking administrative jobs in the larger, more prestigious health organizations. Although some public health departments still require chief administrators to be physicians, the trend is away from this.

Administrators in Armed Forces hospitals usually are career military personnel.

In 1976, over 40 bachelor and associate degree programs in health services administration were offered—the majority were 4-year curriculums. In addition, there were about 52 programs in hospital or health services administration that led to the master's degree, and 19 schools of public health offered programs leading to a master's degree in public health.

To enter graduate programs, applicants must have a bachelor's degree, with courses in natural sciences, psychology, sociology, statistics, accounting, and economics. Competition for entry to these programs is keen, and applicants need above average grades to gain admission. The programs generally last about 2 years and may include some supervised administrative experience in hospitals, clinics, or health agencies. Programs may include courses such as hospital organization and management, accounting and budget control, personnel administration, public health administration, and the economics of health care.

All States and the District of Columbia require that the administrator of a nursing or personal care home be licensed. Requirements are not uniform, but they generally specify a level of education, such as a bache-

lor's degree, plus some amount of experience in the field.

Personal qualifications needed for success as a health administrator include initiative and an interest in helping the sick. Administrators should be able to work with and motivate people, and organize and direct large-scale activities. They also should enjoy public speaking.

Health administrators advance in the profession by taking increasingly more responsible positions. For example, some hospital administrators begin their careers in small hospitals in positions with broad responsibilities, such as assistant administrator. They advance by moving to jobs as associate or chief administrator in larger hospitals. More commonly, they start in a large institution in a position that is somewhat narrow in scope—for example, as department head in charge of purchasing. Regardless of the path of advancement chosen, the ultimate occupational goal in hospitals and nursing homes is the job of chief executive or chief administrative officer.

Employment Outlook

The number of graduate programs in health administration has increased rapidly in recent years and administative specialists with graduate degrees in other fields also have entered the profession. Consequently, it may become more difficult for those with less than graduate education to enter health administration in top management positions. In addition, some administrative jobs will continue to be filled by registered nurses, physicians, and members of religious communities.

Employment of health services administrators is expected to grow much faster than the average for all occupations to 1985 as the quantity of patient services increases and health services management becomes more complex. The demand for administrators will be stimulated by the formation of more group medical practices and health maintenance organizations (facilities that offer subscribers a broad range of medical services for a monthly fee paid in advance). Administrators also will be needed in nursing and convalescent homes to handle the increasing amount of administrative work expected as these facilities expand in size.

Earnings and Working Conditions

Salaries of hospital administrators depend on factors such as the level of job responsibility; the size, type, and location of the hospital; and the size of its administrative staff and budget.

Chief administrators in hospitals with up to 199 beds earned an average of $25,500 a year in 1976. Some, in larger hospitals, earned over $45,000. Recent recipients of master's degrees in health administration starting work in Veterans Administration (VA) hospitals earned $14,097 a year in 1977. The average salary paid administrators of Federal hospitals was $26,700.

Commissioned officers in the Armed Forces who work as hospital administrators hold ranks ranging from second lieutenant to colonel or from ensign to captain. Commanding officers of large Armed Forces hospitals are generally physicians, who may hold higher ranks. Hospital administrators in the U.S. Public Health Service are commissioned officers holding ranks ranging from lieutenant (junior grade) to captain in the Navy.

Administrators of nursing and personal care homes usually earn lower salaries than those paid hospital administrators in facilities having similar numbers of beds. Most administrators employed by voluntary health agencies earned between $15,000 and $30,000 a year in 1976.

Health administrators often work long hours. Because health facilities such as nursing homes and hospitals operate around the clock, administrators in these institutions may be called at all hours to settle emergency problems. Also, some travel may be required to attend meetings or, in the case of regional, State or local public health department and voluntary health agency administrators, to inspect facilities in the field.

Sources of Additional Information

Information about health administration and the academic programs in this field offered by universities, colleges, and community colleges is available from:

American College of Hospital Administration, 840 North Lake Shore Drive, Chicago, Illinois 60611.

Association of University Programs in Health Administration, One Dupont Circle, NW., Washington, D.C. 20036.

American Public Health Association, Division of Program Services, 1015 18th St., NW., Washington, D.C. 20036.

National Health Council, Health Careers Program, 1740 Broadway, New York, N.Y. 10019.

American College of Nursing Home Administrators, 4650 East-West Hwy., Washington, D.C, 20014.

MEDICAL RECORD ADMINISTRATORS

(D.O.T. 100.388)

Nature of the Work

All health care institutions keep records that contain medical information on each patient, including case histories of illnesses or injuries, reports on physical examinations, X-rays and laboratory tests, doctors' orders and notes, and nurses' notes. These records are necessary for correct and prompt diagnosis and treatment of illnesses and injuries. They also are used for research, insurance claims, legal actions, evaluation of treatment and medications prescribed, and in the training of medical personnel. Medical information in hospitals also is used to evaluate patient care provided in the hospital and as a basis for health care planning for the community.

Medical record administrators direct the activities of the medical record department and develop systems for documenting, storing, and retrieving medical information. They supervise the medical record staff, which processes and analyzes records and reports on patients' illnesses and treatment. They train members of the medical record staff for specialized jobs, compile medical statistics required by State or national health agencies, and assist the medical staff in evaluations of patient care

Medical record administrators develop systems for documenting, storing, and retrieving medical information.

or research studies. Medical record administrators serving as department heads are a part of the hospital management staff and participate fully in management activities. As the administrators responsible for the medical information system, they may be required to testify in court about records and record procedures.

The size and type of institution affect the duties and amount of responsibility assigned to medical record administrators. In large hospitals, chief medical record administrators supervise other medical record administrators, technicians, and clerks. Smaller hospitals may employ only two or three persons in the medical record department; in nursing homes usually one person keeps the medical records. In these cases a consulting medical record administrator usually advises technical and clerical personnel performing medical record functions.

Places of Employment

Most of the 12,300 medical record administrators employed in 1976 worked in hospitals. The remainder worked in clinics, nursing homes, State and local public health departments, and medical research centers. Some health insurance companies also employ medical record administrators to help determine liability for payment of their clients' medical fees. Some medical record administrators work for firms that manufacture equipment for recording and processing medical data and develop and print health insurance and medical forms. Many small health care facilities hire medical record administrators as consultants.

Training, Other Qualifications, and Advancement

Preparation for a career as a medical record administrator is offered in specialized programs in colleges and universities. Most programs last 4 years and lead to a bachelor's degree in medical record administration. However, concentration in medical record administration begins in the third or fourth year of study, making transfer from a junior college possible. One-year certificate programs also are available for those who already have a bachelor's degree and required courses in the liberal arts and biological sciences. In 1977, there were 41 programs in medical record administration approved by the Council on Medical Education of the American Medical Association and the American Medical Record Association (AMRA). High school courses that are useful include health, business administration, mathematics, and biology.

Training for medical record administrators includes both classroom instruction and practical experience. Anatomy, physiology, fundamentals of medical science, medical terminology, and medical record science are among the required scientific courses. In addition, management courses such as hospital organization and administration, health law, statistics, data processing, and computer science are part of the curriculum. Experience in the medical record departments of hospitals provides students with a practical background in applying standardized medical record practices, compiling statistical reports, analyzing data, and organizing medical record systems.

Graduates of approved schools in medical record administration are eligible for the national registration examination given by AMRA. Passing this examination gives professional recognition as a Registered Record Administrator (RRA). There were about 5,000 employed RRA's in 1976, according to AMRA.

Medical record administrators must be accurate and interested in detail. They also must be able to communicate clearly in speech and writing. Because medical records are confidential, medical record administrators must be discreet in processing and releasing information. Supervisors must be able to organize and analyze work procedures and to work effectively with other hospital personnel.

Medical record administrators with some experience in smaller health facilities may advance to positions as department heads in large hospitals or to higher level positions in hospital administration. Some coordinate the medical record departments of several small hospitals. Others move on to medical record positions in health agencies. Many

teach in the expanding programs for medical record personnel in 2- and 4-year colleges and universities.

Employment Outlook

Employment opportunities for graduates of approved medical record administrator programs are expected to be good through the mid-1980's. Employment is expected to grow faster than the average for all occupations, with the increasing use of health facilities as more and more people are covered by health insurance. The detailed information required by third-party payers such as insurance companies and Medicare also will cause growth in the occupation. More consultants will be needed to standardize health records in outpatient clinics, community health centers, nursing homes, and home care programs. The importance of medical records in research and the growing use of computers to store and retrieve medical information also should increase the demand for qualified medical record administrators to develop new medical information systems. Part-time employment opportunities also should be available in teaching, in research, and in consulting work for health care facilities.

Earnings and Working Conditions

The salaries of medical record administrators are influenced by the location, size, and type of employing institution, as well as by the duties and responsibilities of the position. The average starting salary for medical record administrators in 1976 was $12,312 a year, according to a national survey conducted by the University of Texas Medical Branch at Galveston. Top salaries averaged $14,916 a year, with some earning as much as $27,612.

Newly graduated medical record administrators employed by the Federal Government generally started at $9,303 a year in 1977; those having bachelor's degrees and good academic records were eligible to begin at $11,523. In 1977, the Federal Government paid experienced medical record administrators average salaries of $15,700 a year.

Medical record administrators usually work a regular 36- to 40-hour week and receive paid holidays and vacations.

Sources of Additional Information

Information about approved schools and employment opportunities is available from:

American Medical Record Association, John Hancock Center, Suite 1850, 875 N. Michigan Ave., Chicago, Ill. 60611.

PHARMACISTS

(D.O.T. 074.181)

Nature of the Work

Pharmacists dispense drugs and medicines prescribed by medical and dental practitioners and supply and advise people on the use of many medicines that can be obtained with and without prescriptions. Pharmacists must understand the use, composition, and effect of drugs and often test them for purity and strength. They may maintain patient medication profiles and advise physicians on the proper selection and use of medicines. Compounding—the actual mixing of ingredients to form powders, tablets, capsules, ointments, and solutions—is now only a small part of pharmacists' practice, since most medicines are produced by manufacturers in the form used by the patient.

Many pharmacists employed in community pharmacies also have other duties. Besides dispensing medicines, some pharmacists buy and sell nonpharmaceutical merchandise, hire and supervise personnel, and oversee the general operation of the pharmacy. Other

Pharmacists often test drugs for purity and strength.

pharmacists, however, operate prescription pharmacies that dispense only medicines, medical supplies, and health accessories.

Pharmacists in hospitals and clinics dispense prescriptions and advise the medical staff on the selection and effects of drugs; they also make sterile solutions, buy medical supplies, teach in schools of nursing and allied health professions, and perform administrative duties. An increasing number of pharmacists work as consultants to the medical team in matters related to daily patient care in hospitals, nursing homes, and other health care facilities. Their role is crucial to safe, efficient, and proper therapeutic care.

Some pharmacists, employed as sales or medical service representatives or pharmaceutical detailers by drug manufacturers and wholesalers, sell medicines to retail pharmacies and to hospitals, and inform health personnel about new drugs. Others teach in colleges of pharmacy, supervise the manufacture of pharmaceuticals, or are involved in research and the development of new medicines. Some pharmacists edit or write technical articles for pharmaceutical journals, or do administrative work. Some combine pharmaceutical and legal training in jobs as patent lawyers or consultants on pharmaceutical and drug laws.

Places of Employment

About 120,000 persons worked as licensed pharmacists in 1976. Over 90,000 pharmacists worked in community pharmacies. Of these, more than two-fifths owned their own pharmacies; the others were salaried employees. Most of the remaining salaried pharmacists worked for hospitals, pharmaceutical manufacturers, and wholesalers. Quite a few community and hospital pharmacists did consulting work for nursing homes and other health facilities in addition to their primary jobs. As a rule, pharmacy services in nursing homes are provided by consultants rather than by salaried employees.

Some pharmacists were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the U.S. Public Health Service. Additional Federal agencies employing pharmacists include the Department of Defense, the Food and Drug Administration and other branches of the Department of Health, Education, and Welfare, and the Drug Enforcement Administration. Other pharmacists served in the Armed Forces or taught in colleges of pharmacy. State and local health agencies, and pharmaceutical and other professional associations, also employ pharmacists.

Most towns have at least one pharmacy with one pharmacist or more in attendance. Most pharmacists, however, practice in or near cities, and in those States that have the largest populations.

Training, Other Qualifications, and Advancement

A license to practice pharmacy is required in all States and the District of Columbia. To obtain a license, one must be a graduate of an accredited pharmacy college, pass a State board examination and—in nearly all States—have a specified amount of practical experience or internship under the supervision of a registered pharmacist. Internships generally are served in a community or hospital pharmacy. In 1976, all States except California, Florida, and Hawaii granted a license without reexamination to qualified pharmacists already licensed by another State. Many pharmacists are licensed to practice in more than one State.

At least 5 years of study beyond high school are required to graduate from one of the degree programs accredited by the American Council on Pharmaceutical Education in the 72 colleges of pharmacy. Most graduates receive a Bachelor of Science (B.S.) or a Bachelor of Pharmacy (B. Pharm.) degree. About one-third of the colleges of pharmacy also offer advanced professional degree programs leading to a Doctor of Pharmacy (Pharm. D.) degree; three of the schools offer only the Pharm. D. degree. The Pharm. D. degree as well as the B.S. or B. Pharm. degrees may serve as the entry degree for purposes of licensure as a pharmacist. The profession is considering standardizing requirements and offering only one professional degree instead of two.

Admission requirements vary. A few colleges admit students directly from high school. Most colleges of pharmacy, however, require entrants to have completed 1 or 2 years of prepharmacy education in an accredited junior college, college, or university. A prepharmacy curriculum usually emphasizes mathematics and basic sciences, such as chemistry, biology, and physics, but also includes courses in the humanities and social sciences. Because entry requirements vary among colleges of pharmacy, prepharmacy students should inquire about and follow the curriculum required by colleges they plan to attend.

The bachelor's degree in pharmacy is the minimum educational qualification for most positions in the profession. An increasing number of students are enrolled in advanced professional programs leading to the Pharm. D. degree. A master's or Ph. D. degree in pharmacy or a related field usually is required for research work and a Pharm. D., master's, or Ph. D. usually is necessary for administrative work or college teaching. While a number of pharmacy graduates interested in further training pursue a Pharm. D. or a master's or Ph. D. in pharmacy, there are other options. Some enter medical, dental, or law school, and others pursue graduate degrees in science or engineering.

Areas of special study include pharmaceutics and pharmaceutical chemistry (study of physical and chemical properties of drugs an dosage forms), pharmacology (study of the effects of drugs on the body), pharmacognosy (study of the drugs derived from plant or animal sources), hospital pharmacy, clinical pharmacy, and pharmacy administration (study of the social and economic factors related to pharmacy practice). Clinical pharmacy is the synthesis of the basic science education and the application of this knowledge to drug management problems in the care of patients. Courses in pharmacy administration are particularly helpful to pharmacists who enter executive or managerial positions.

All colleges of pharmacy offer courses in pharmacy practice, designed to educate students in the skilled processes required for compounding and dispensing prescriptions, and to give students an appreciation for the profession and an understanding of the responsibilities pharmacists have in their relationships with physicians and patients. Many colleges of pharmacy increasingly are emphasizing direct patient care as well as consultative services to other health professionals in their academic programs.

A limited number of Federal scholarships and loans are available for students studying full time toward a degree in pharmacy. A number of scholarships also are awarded annually by drug manufacturers, chain drugstores, corporations, State and national pharmacy associations, colleges of pharmacy, and other organizations.

Since many pharmacists are self-employed, prospective pharmacists with interest in this type of practice should have some business ability, as well as an interest in medical science and the ability to gain the confidence of their clients. Honesty, integ..ty, and orderliness are important attributes for the profession. In addition, accuracy is needed to compound and dispense medicines as well as keep records required by law.

Pharmacists often begin as employees in community pharmacies. After they gain experience and obtain the necessary funds they may become owners or part-owners of pharmacies. A pharmacist who gains experience in a chain drugstore may advance to a managerial position, and later to a higher executive position within the company. Hospital pharmacists who have the necessary training and experience may advance to director of pharmacy service or to other administrative positions. Pharmacists in industry often have opportunities for advancement in management, sales, research, quality control, advertising, production, packaging, and other areas.

Employment Outlook

The employment outlook for pharmacists is expected to be favorable through the mid-1980's. However, if the number of pharmacy college graduates continues to rise as rapidly as it has in recent years, the job market may change; graduates may begin to experience competition for jobs. Growth is expected to be about as fast as the average for all occupations. Most openings, however, will result from deaths, retirements, and other separations from the labor force.

Employment will grow as new pharmacies are established, in large residential areas as well as in small towns and rural locations. Many community pharmacies, also, are expected to hire additional pharmacists because of a trend towards shorter working hours. Demand for pharmacists also will be generated by such factors as population growth; increased life expectancy; greater demand for drugs, particularly among the elderly; availability of a wider range of drug products for preventive and therapeutic uses; the rising standard of health care; and the growth of public and private health insurance programs that provide payment for prescription drugs.

Employment of pharmacists in hospitals, nursing homes, and other health facilities is expected to rise faster than in other work settings. Pharmacists increasingly provide direct patient care and consultative services to physicians and other professionals in these health facilities. Because drug manufacturers are experiencing lower rates of return on investment in research and development due to increasing government regulation, pharmacists may face decreasing opportunities in production, research, distribution, and sales. Pharmacists with advanced training will be needed for college teaching and top administrative posts.

Earnings and Working Conditions

Based on limited information, the starting salary for pharmacists generally ranges from $14,000 to $17,000 a year. Experienced pharmacists, particularly owners or managers of pharmacies, often earn considerably more. In general, salaries of experienced pharmacists are higher than the average for all nonsupervisory workers in private industry, except farming.

The minimum entrance salary in the Federal Government for a new graduate with a bachelor's degree from an approved college of pharmacy was $11,523 a year in 1977. However, most graduates qualified for a beginning salary of $14,097 a year; those with 2 years of graduate work, $17,056 a year. Pharmacists with additional years of experience may start at a higher salary. The average salary for all federally employed pharmacists was about $18,600.

The average annual starting salary for pharmacists in hospitals and medical centers was about $14,600 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced pharmacists in these settings averaged $18,300, and some were as high as $26,200. Pharmacists who do consulting work in addition to their primary job may have total earnings considerably higher than this.

According to a survey conducted by the American Association of Colleges of Pharmacy, average annual salaries of full-time personnel in colleges of pharmacy during 1977 were as follows: deans, about $36,000; assistant and associate deans, about $25,000; full professors, around $30,000; associate professors, around $23,000; and assistant professors, about $20,000.

Based on the latest Pharmacy Manpower Information Project initiated by the American Association of Colleges of Pharmacy, pharmacists average 44 hours a week in their primary work setting. Many pharmacists work in a secondary setting where they average 15 hours a week. Pharmacists in community settings generally work longer hours than those employed in institutional settings. Pharmacies often are open in the evenings and on weekends, and all States require a registered pharmacist to be in attendance during store hours. Self-employed pharmacists often work more hours than those in salaried positions.

Sources of Additional Information

Additional information on pharmacy as a career, preprofessional and professional requirements, programs offered by colleges of pharmacy, and student financial aid is available from:

American Association of Colleges of Pharmacy, Office of Student Affairs, 4630 Montgomery Ave., Suite 201, Bethesda, Md. 20014.

General information on pharmacy is available from:

American Pharmaceutical Association, 2215 Constitution Ave. NW., Washington, D.C. 20037.

Information about chain drugstores is available from:

National Association of Chain Drug Stores, 1911 Jefferson Highway, Arlington, Va. 22202.

General information on retail pharmacies is available from:

National Association of Retail Druggists, 1750 K St., NW., Washington, D.C. 20006.

For a list of accredited colleges of pharmacy, contact:

American Council on Pharmaceutical Education, One East Wacker Dr., Chicago, Ill. 60601.

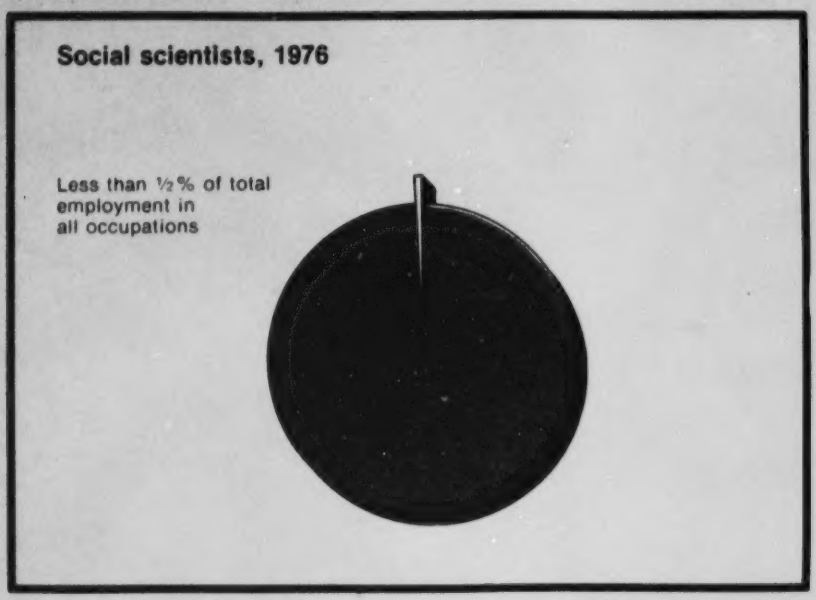
Information on requirements for licensure in a particular State is available from the Board of Pharmacy of that State or from:

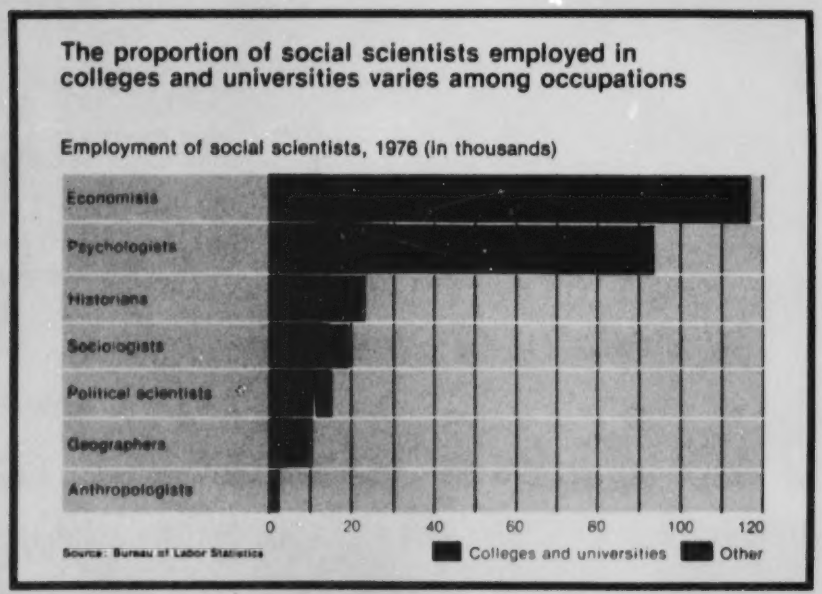
National Association of Boards of Pharmacy, One East Wacker Dr., Chicago, Ill. 60601.

Information on college entrance requirements, curriculums, and financial aid is available from the dean of any college of pharmacy.

SOCIAL SCIENTISTS

Social scientists study all aspects of human society—from the origins of man to the latest election returns. Regardless of their field of specialization, they are concerned with some aspect of society, culture, or personality. Anthropologists study primitive tribes and modern communities, reconstruct civilizations of the past, and analyze the physical characteristics, cultures, and languages of all people, past and present. Economists study the allocation of land, labor, and capital, and the production, distribution, and consumption of goods and services. Geographers study the relationship between geographic factors and economics, politics, urban problems, culture, health problems, and other areas. They also seek to explain changing patterns of human settlement. Historians describe and interpret the people, ideas, institutions, and events of the past and present. Political scientists study the theories, objectives, and organization of all types of government. Psychologists study the behavior of humans and lower animals in order to understand and explain their actions, and assist in adjustment or rehabilitation when necessary. Sociologists analyze the behavior and relationships of groups—such as the family, the community, and minorities—to the individual or to society as a whole. Besides these basic social science occupations, a number of closely related fields are covered in separate statements elsewhere in this *Handbook*. (See statements on statisticians, social workers, and other social service occupations.)

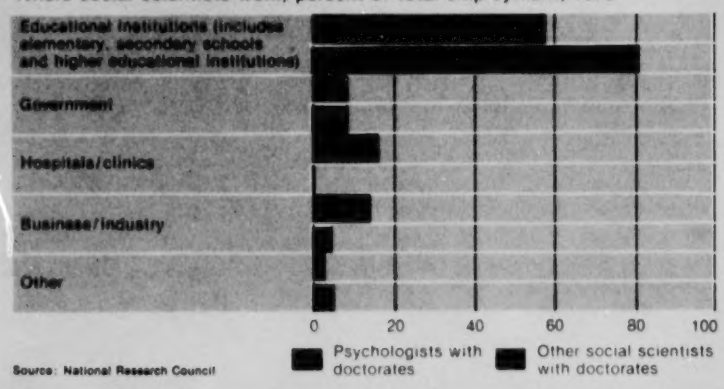




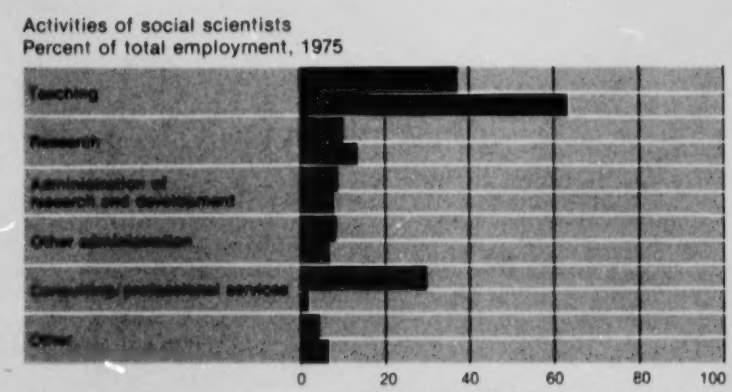
The basic social science occupations provided employment for about 280,000 persons in 1976. Overlapping among the basic social science fields makes it difficult to determine the exact size of each profession. Economists, however, make up the largest social science group and anthropologists the smallest.

About one-third of all social scientists work in colleges and universities. However, the two largest social science occupations, economists and psychologists, are not as heavily concentrated in institutions of higher

Significant proportions of psychologists with doctoral degrees work in nonacademic settings



Teaching is the principal activity of social scientists with doctoral degrees



education as other social scientists. (See chart.)

Federal, State, and local government agencies, research and consulting firms, hospitals and other health facilities, and unions, associations, and nonprofit organizations also employ social scientists. Business firms of all kinds are important employers of social scientists. Banks, insurance companies, retailers, and manufacturing concerns all employ social science majors as trainees for sales, research, administrative, and executive positions.

Overall employment in the social sciences is expected to grow about as fast as the average for all occupations through the mid-1980's. Economists, psychologists, and geographers are expected to experience faster than average growth; anthropologists will grow about as fast as average; and political scientists, sociologists, and historians will grow more slowly than average. Colleges and universities, the traditional employers of many highly qualified social scientists, are not expected to offer as many job opportunities through 1985 as they did in the past, because of the slowing of enrollment growth. Top graduates of prestigious universities should have an advantage for the limited number of academic positions. Most employment growth should occur in nonacademic areas, and many highly qualified social scientists are expected to seek such positions. Despite this anticipated growth, the number of persons seeking to enter the social science field is likely to exceed the available job openings. The following statements present more detailed information about the prospective outlook in the individual occupations.

ANTHROPOLOGISTS

(D.O.T. 055.088)

Nature of the Work

Anthropologists study man—his origins, physical characteristics, and culture. These areas of study examine people's traditions, beliefs, customs, languages, material possessions, social relationships, and value systems. Although anthropologists generally specialize in one of four specific areas—cultural anthropology, archeology, linguistics, and physical anthropology—they are expected to have a general knowledge of all of them.

Most anthropologists specialize in cultural anthropology, sometimes called ethnology. *Ethnologists* may spend long periods living with tribal groups or in modern communities to learn about their ways of life. The cultural anthropologist lives with a group of people to observe and write about their social customs, beliefs, and material possessions. They usually learn the native language in the process. They also make comparative studies of the cultures and societies of various groups. In recent years, investigations have included fewer primitive societies and more complex urban societies, including

ghetto inhabitants, drug addicts, and the aged.

Archeologists study cultures which no longer exist or have changed greatly. They study the remains of homes, tools, clothing, ornaments, and other evidences of human life and activity to reconstruct the inhabitants' history and customs. For example, in a desert in New Mexico, archeologists uncovered an ancient kiva— an Indian religious chamber. In a cave by the Dead Sea, some have found pieces of ancient scrolls 2,000 years old. Archeological teams also have excavated three large prehistoric communities along the Illinois River.

Linguistic anthropologists study the evolution of language and the place of language in a culture. They examine the sounds and structure of a society's language and relate them to the behavior and thought patterns of members of that society. Such studies may be used to trace the diffusion of a language or people over wide geographical areas.

Physical anthropologists studying human evolution investigate how the physical characteristics of different races or groups of people are influenced by heredity and environment. This work requires extensive training in human anatomy, biology, genetics, and the study of primates (the order of mammals that includes man, apes, and monkeys). A physical anthropologist may identify a fossil of a human ancestor or teach a chimpanzee to communicate with sign language. A knowledge of body structure enables physical anthropologists to work as consultants on projects such as the design of cockpits for airplanes and spaceships, and the sizing of clothing.

Most new employment opportunities are expected to be in *applied anthropology*, a specialty which uses the findings of anthropology in a practical manner. Applied cultural anthropologists may, for example, provide technical guidelines to ease the transition of nonindustrial societies to a more complex level of socioeconomic organization, or a medical anthropologist studying cultural attitudes towards health and medical treatment may help formulate and administer a health program for an ethnic minority. Many medical schools hire medical anthropologists as instructors.

Applied linguistic anthropologists may create a written alphabet to help advance literacy in societies with unwritten languages. Another related specialty area is *urban anthropology*, the study of urban life, urbanization, rural-urban migration, and the influence of city life.

Most anthropologists teach in colleges and universities, and they often combine teaching with research. Some specialize in museum work, which generally combines administrative duties with fieldwork and research on anthropological collections. Anthropologists also write cultural, social, and archeological impact statements for proposed Government projects. Some work in business and industry including construction firms or engage in nontechnical writing.

Places of Employment

About 3,500 persons worked as anthropologists in 1976. About four-fifths of all anthropologists work in colleges and universities. The Federal Government employs a small but growing number, chiefly in museums, national parks, the Bureau of Indian Affairs, the Army Corps of Engineers, and technical aid programs. State and local government agencies employ anthropologists, usually for museum work or health research. Some work as consultants in private, community, or overseas development organizations.

Training, Other Qualifications, and Advancement

Students who want to become anthropologists should obtain the Ph. D. degree. College graduates with bachelor's degrees often get temporary positions and assistantships in graduate departments where they are working for advanced degrees. A master's degree, plus field experience, is sufficient for many beginning professional positions, but promotion to top positions generally is reserved for individuals who have a Ph. D. degree. Many colleges and universities require a Ph. D. degree for permanent teaching appointments. Persons with a master's or bachelor's degree in anthropology may be hired as government social science analysts or placed in managerial positions by private employers.

A student interested in studying anthropology should have a strong background in the social and physical sciences. Mathematics is helpful, since statistical and computer methods are becoming more widely used for research in this field. Undergraduates may begin their field training in archeology by arranging, through their university departments, to accompany expeditions as laborers or to attend field schools established for training. They may later become supervisors in charge of the digging or collection of material and finally may direct a portion of the work of the expedition. Ethnologists and linguists usually do their fieldwork independently. Most anthropologists base their doctoral dissertations on data collected through field research; they are, therefore, experienced fieldworkers by the time they earn the Ph. D. degree.

Nearly 300 colleges and universities have bachelor's degree programs in anthropology; some 130 offer master's degree programs and about 80, doctoral programs. The choice of a graduate school is very important. Students interested in museum work should select a school which is associated with a museum that has anthropological collections. Similarly, those interested in archeology should choose either a university that offers opportunities for summer experience in archeological fieldwork, or attend an archeological field school elsewhere during summer vacations.

Anthropologists should have special interest in natural history and social studies and enjoy reading, research, and writing. Traveling to remote areas, working in an uncomfortable climate, and living in primitive housing are sometimes necessary.

Anthropologists work with ideas and have the opportunity for self-expression. They should be able to work independently and with detail.

(For information on advancement, see the *Handbook* statement on College and University Teachers.)

Employment Outlook

Employment of anthropologists is expected to increase about as fast as the average for all occupations. Most new jobs are expected to be in private industry, the Federal Government, mental and public health agencies, and urban planning departments of city governments. College and university teaching, which will remain the largest area of employment for anthropologists, is likely to have little growth due to the projected slowdown in college enrollments.

The number of qualified anthropologists seeking to enter the field will likely exceed available positions. As a result, doctorate holders may face keen competition through the mid-1980's, particularly for jobs in colleges and universities. Graduates with only bachelor's and master's degrees are expected to face very keen competition, although they may be preferred for some nonacademic positions. Some teaching positions may be available in junior colleges or high schools for those who meet state certification requirements.

Earnings and Working Conditions

Starting salaries for anthropologists with a Ph. D. degree were generally about $16,000 a year in 1976. Most experienced anthropologists earned between $17,000 and $27,000 a year, according to limited data available. In general, salaries of experienced anthropologists are a little less than the average for all social science professional workers.

In the Federal Government, anthropologists having a bachelor's degree could begin as trainees at $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. The starting salary for those having a master's degree was $14,097 a year, for those having a Ph. D., $17,056. Anthropologists in the Federal Government averaged around $23,800 in 1977.

Many anthropologists in colleges and universities supplement their regular salaries with earnings from other sources such as summer teaching and research grants.

Anthropologists sometimes are required to do fieldwork under adverse weather conditions. They also must adapt themselves to cultural environments which are materially and socially different.

Sources of Additional Information

For information about employment opportunities and schools that offer graduate training in anthropology, contact:

The American Anthropological Association, 1703 New Hampshire Ave. NW., Washington, D.C. 20009.

The Archeological Institute of America, 260 W. Broadway, New York, N.Y. 10013.

ECONOMISTS

(D.O.T. 050.088 and .118)

Nature of the Work

Economists are concerned with how to utilize scarce resources such as land, raw materials, and human resources to provide goods and services for society. Economists analyze the relationship between the supply and demand of goods and services and study how they are produced, distributed, and consumed. Some economists are concerned with specific fields such as farm, wage, tax, and tariff problems and policies, while others attempt to develop theories explaining the causes of employment and unemployment or inflation. Most economists analyze and interpret a wide variety of economic data in the course of their work.

Economists in colleges and universities are engaged primarily in teaching the theories, principles, and methods of economics. In addition, economics faculty members often are involved in research, writing, and other nonteaching activities. They frequently act as consultants to business firms, government agencies, or individuals.

Economists in government collect and analyze data and prepare studies used to assess economic conditions and the need for changes in government policy. Most government economists are in the fields of agriculture, forestry, business, finance, labor, transportation, or international trade and development. For example, economists in the U.S. Department of Commerce study domestic production, distribution, and consumption of commodities or services;

Economics is the largest social science field.

in the Federal Trade Commission, economists prepare economic evidence or industry analyses to assist in enforcing Federal statutes designed to eliminate unfair, deceptive, or monopolistic practices in interstate commerce; economists in the Bureau of Labor Statistics assist in survey planning and analyze data on prices, wages, employment, and productivity.

Economists who work for business firms provide management with information to make decisions on marketing and pricing of company products; analyze the effect of government policies on business or international trade; or look at the advisability of adding new lines of merchandise, opening new branch operations, or otherwise expanding the company's business. Business economists working for firms that carry on extensive operations abroad may be asked to prepare short- and long-term forecasts of foreign economies as well as forecasts of the U.S. economy.

Places of Employment

Economics is the largest social science field. About 115,000 persons worked as economists in 1976, excluding those teaching in secondary schools. About 3 out of 4 of these jobs are in private industry or research organizations. Important employers of economists include manufacturing firms, banks, insurance companies, securities and investment companies, and management consulting firms. Colleges and universities employ about 10 percent of the Nation's economists while government agencies, primarily Federal, employ another 10 percent. Some economists run their own consulting businesses.

Economists work in all large cities and university towns. The largest number are in the New York City and the Washington, D.C. metropolitan areas. Some work overseas, mainly for the U.S. Department of State including the Agency for International Development.

Training, Other Qualifications, and Advancement

Economists must have a thorough understanding of economic theory and of mathematical methods of economic analysis. Since many beginning jobs for economists in government and business involve the collection and compilation of data, a thorough knowledge of basic statistical procedures is required. In addition to courses in macroeconomics, microeconomics, econometrics, and business and economic statistics, training in computer science is highly recommended.

At the undergraduate level, courses in one or more of the following subjects also are valuable: business cycles; economic and business history; economic development of selected areas; money and banking; international economics; public finance; industrial organization; labor economics; comparative economic systems, economics of national planning; urban economic problems and policies; marketing principles and organization; consumer analysis; organizational behavior; and business law.

A bachelor's degree with a major in economics is sufficient for many beginning research, administrative, management trainee, and business sales jobs. However, graduate training increasingly is required for advancement to more responsible positions as economists. Areas of specialization at the graduate level include advanced economic theory, comparative economic systems and planning, econometrics, economic development, economic history, environmental and natural resource economics, history of economic thought, industrial organization, institutional economics, international economics, labor economics, monetary economics, public finance, regional and urban economics, and social policy. Students should select graduate schools strong in specialties in which they are interested. Some schools help graduate students find part-time employment in nearby government or private organizations engaged in economic research where students may gain valuable experience.

In the Federal Government, candidates for entrance positions must have a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus.

A master's degree generally is the minimum requirement for a job as a college instructor in many junior colleges and small 4-year schools. In many large colleges and universities, completion of all the requirements for a Ph. D. degree, except the dissertation, is necessary for appointment as a teaching assistant or instructor. The Ph. D. degree usually is required for a professorship and almost always is necessary to gain tenure.

In government, industry, research organizations, and consulting firms, economists who have a graduate degree usually can qualify for more responsible research and administrative positions. Experienced business economists may advance to managerial or executive positions in banks, industrial concerns, trade associations and other organizations where they formulate practical business and administrative policy.

About 1,500 colleges and universities offer bachelor's degree programs in economics; about 230, master's; and about 120, doctoral programs.

Persons who consider careers as economists should be able to work accurately and in detail since much time is spent on careful analysis of data. Frequently, the ability to work as part of a team is required. Economists must be objective in their work and be able to express themselves effectively both orally and in writing.

Employment Outlook

Employment of economists is expected to grow faster than the average for all occupations through the mid-1980's. However, most openings will result from deaths, retirements, and other separations from the labor force.

Private industry and business will continue to provide the largest number of employment opportunities for economists because of the increasing complexity of the domestic and international economies and the increased reliance on quantitative methods of analyzing business trends, forecasting sales, and planning purchases and production operations. Employers will seek those well-trained in econometrics and statistics. In addition, the increasing need for business economists to assist

lawyers, accountants, engineers, and other professionals in solving problems should stimulate employment growth. Employment of economists in State and local government agencies is expected to increase because of the growing responsibilities of local governments in areas such as housing, transportation, environment and natural resources, health, and employment development and training. Employment of economists in the Federal Government is expected to rise slowly—in line with the rate of growth projected for the Federal work force as a whole. Colleges and universities, the traditional employer of many highly qualified economists, are not expected to significantly increase employment. As a result, many such economists may seek nonacademic positions.

Persons who graduate with a bachelor's degree in economics through the mid-1980's are likely to face keen competition for jobs as economists. However, many of these degree holders will find employment in government, industry, and business as management or sales trainees, or as research assistants. Candidates who hold master's degrees in economics face very strong competition for teaching positions in colleges and universities, but they should find good opportunities for administrative, research, and planning positions in private industry and government. Ph. D.'s are likely to face competition for academic positions, although those graduating from high-ranking universities should have an advantage. Ph. D.'s should have favorable opportunities in government, industry, research organizations, and consulting firms.

Economists specializing in the environment, energy and natural resources, health, and transportation are expected to have good job opportunities. However, since practicing economists may shift from one specialty to another, fields of specialization offering favorable job opportunities may change over short periods of time. A strong background in economic theory and econometrics provides the tools for acquiring any specialty within the field.

Earnings

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000; bachelor's degree candidates offered positions in the field of finance and economics, around $10,600.

According to an American Economic Association survey, average salary offers made to new Ph. D.'s for the academic year 1975-76 were as follows: in colleges and universities, around $13,100 to $14,600 for the 9-month academic year; in business and industry, $18,000 a year; in banking and finance, $17,775 a year; in consulting and research, $17,500 a year; in the Federal Government, $18,750 a year; and in State and local government, $15,500 a year. Average salaries of economists employed in colleges and universities for the academic year 1975-76 were as follows: for professors, about $25,400; for associate professors, about $18,700; for assistant professors, about $15,300; and for instructors, about $12,100.

Economists who have a Ph. D. generally are paid higher salaries than those who have lesser degrees and similar experience. A substantial number of economists supplement their salaries by consulting, teaching, and research activities. In general, salaries of experienced economists are much higher than the average for all nonsupervisory woqkers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for economists having a bachelor's degree was $9,303 a year in 1977; however, those with superior academic records could begin at $11,523. Those having a master's degree could qualify for positions at an annual salary of $14,097, while those with a Ph. D. could begin at $17,056. Economists in the Federal Government averaged around $25,100 in 1977. Economists work in many government agencies, primarily in the Departments of State, Treasury, Army, Interior, Agriculture, Commerce, Labor, Health, Education, and Welfare, Housing and Urban Development, and Transportation.

Sources of Additional Information

For information on job openings for economists with graduate degrees and on schools offering graduate training in economics, contact:

American Economic Association, 1313 21st Avenue South, Nashville, Tenn. 37212.

For additional information on careers in business economics, contact:

National Association of Business Economists, 28349 Chagrin Blvd., Suite 201, Cleveland, Ohio 44122.

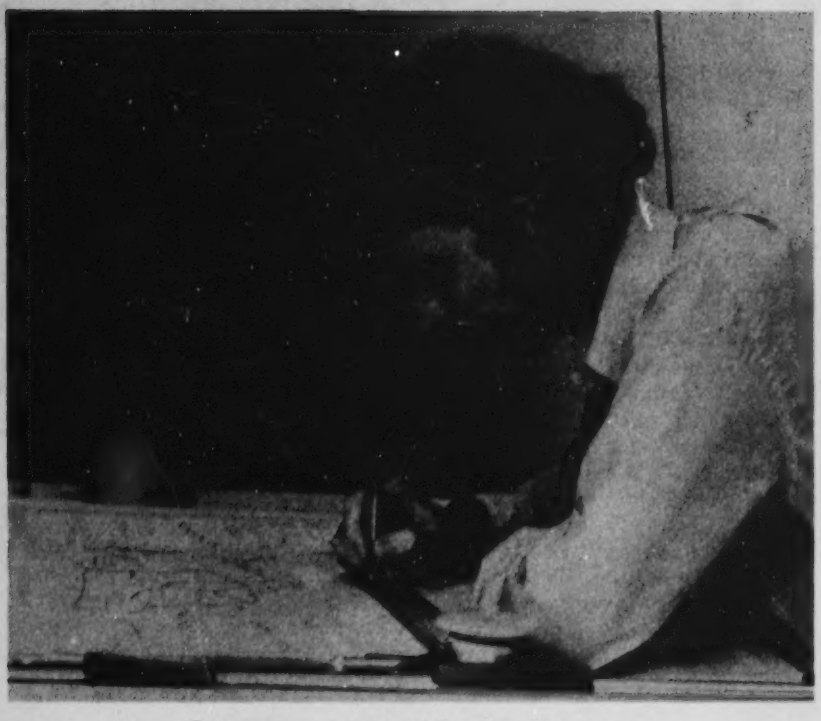
GEOGRAPHERS

(D.O.T. 017.281, 029.088, and 059.088)

Nature of the Work

Geographers study the spatial characteristics of the earth—and all that is found on it. Such studies help to explain changing patterns of human settlement—where people live, why they are located there, and how they earn a living.

Geographers are involved in a variety of activities. Most are college or university teachers; others are involved in research, writing, and other nonteaching activities. Their research includes the study and analysis of the distribution of land forms, climate, soils, vegetation, mineral, water, and human resources. They also analyze the distribution and structure of political organizations, transportation systems, marketing systems, urban systems, agriculture, and industry. Many geographers spend considerable time in field study, using surveying and meteorological instruments. They analyze maps, aerial photographs, and data transmitted by remote sensing equipment on satellites, and apply advanced statistical techniques in their



Some geographers specialize in making maps.

work. Some geographers also construct maps, graphs, and diagrams.

Economic geographers deal with the geographic distribution of economic activities—including manufacturing, mining, agriculture, trade, and communications. *Political geographers* study the relationship of geographic conditions to political affairs. *Urban geographers* study cities and their problems and make recommendations about community planning and development, including housing, transportation, and industrial plant sites. (See statement on Urban Planners elsewhere in the *Handbook*.) The physical characteristics and processes affecting the earth are the concerns of *physical geographers*. Typically, they specialize in a particular branch of physical geography such as hydrology—the study of water and its effects, or geomorphology, which is the study of land forms. *Regional geographers* study the physical, economic, political, and cultural characteristics of a particular region or area, which may range in size from a river basin or an island, to a State, a country, or even a continent. *Cartographers* compile and interpret data and design and construct maps and charts. They also conduct research in surveying and mapping techniques and procedures. A growing number of *medical geographers* are concerned with the geographic aspects of human health problems and planning of health services. They study the effect of the natural environment on health, including such factors as climate, vegetation, mineral traces in water, and atmospheric pollution, as well as the geographic distribution of human health problems and health care facilities.

Formal training in geography provides the background for a wide range of jobs requiring expertise in environmental resources and planning, research methods, and a variety of other areas. Examples of such jobs are aerial photo interpreter, climatologist, community development specialist, ecologist, intelligence analyst, map analyst, land economist, marketing analyst, regional planner, research analyst, site researcher, and transportation planner. Jobs such as these generally require knowledge not only of geography, but of other disciplines as well. Particularly useful combinations include geography and economics, political science, sociology, anthropology, or urban planning.

Places of Employment

About 10,000 persons worked as geographers in 1976, excluding those teaching in secondary schools.

Colleges and universities employ about three-fifths of all geographers. However, the Federal Government is an important employer of geographers, and many work in the Washington, D.C. area. For these geographers, employed mostly by mapping and intelligence agencies, skills in cartography, aerial photograph interpretation, and remote sensing are important.

The principal Federal employers are the Departments of Defense, Interior, Commerce, and Agriculture. Other agencies include the Departments of State; Transportation; and Health, Education, and Welfare; and the Environmental Protection Agency (EPA), National Aeronautical and Space Administration (NASA), Energy Research and Development Agency (ERDA), and Central Intelligence Agency (CIA).

State and local governments employ a growing number of geographers, mostly on city and State planning and development commissions.

Private industry employs a small but growing number of geographers involved in research, planning, and location analysis. Most work for textbook and map publishers, travel agencies, manufacturing firms, real estate development corporations, insurance companies, communications and transportation firms, or chain stores. Others work for scientific foundations and research organizations, or run their own research or consulting business.

Training, Other Qualifications, and Advancement

The minimum educational requirement for beginning positions in geography in government, industry, or secondary schools usually is a bachelor's degree with a major in the field. Bachelor's degree holders would find it helpful to have training in a specialty such as cartography, aerial photograph or remote sensing data

interpretation, statistical analysis, or environmental analysis.

A master's degree usually is the minimum requirement for the position of college instructor, and is important for advancement in business and government. In many colleges and universities, however, a Ph. D. degree usually is required for a professorship and often is necessary to gain tenure. The Ph. D. degree often is necessary for senior level planning, research, and administrative positions in government, industry, research organizations, and consulting firms.

In the Federal Government, geographers generally must have a minimum of 24 semester hours in geography or related fields. Requirements may vary for certain specialties such as cartography.

About 400 colleges and universities offered programs in geography in 1976. Undergraduate study provides a general introduction to the field of geography and often includes field study. Research methods and writing skills also are taught. Typical courses offered are physical geography, cultural geography, climatology and meteorology, economic geography, political geography, urban geography, and quantitative methods in geography. Courses in cartography, remote sensing, historical geography, ecology, natural resource planning, social geography, geography of transportation, geographic aspects of pollution, and geography of various regions also are offered. Geography majors should take appropriate electives in other departments. For example, courses in economics, architecture, urban planning, and urban and rural sociology are important for planners; courses in drawing, design, computer science, and mathematics are important for cartographers; and courses in physics, botany, and geology are important for physical geographers.

In 1976, about 150 institutions offered master's degree programs; 55 offered Ph. D. programs. Applicants are required to have a bachelor's degree in any of the social or physical sciences with a substantial background in geography. Requirements for advanced degrees include field and laboratory work as well as advanced classroom study in geography and preparation of a thesis. Many graduate schools also require course work in advanced mathematics, statistics, and computer science because of the increasing emphasis on these areas in the field. A language may be required for those students who plan to enter the field of foreign regional geography.

Students should select graduate schools that offer appropriate areas of specialization and good research opportunities in nearby libraries, archives, laboratories, and field stations. Employment often is available at area government agencies or research, scientific, or industrial firms.

Persons who want to become geographers should enjoy reading, studying, and research because they must keep abreast of developments in the field. Geographers must work with abstract ideas and theories as well as do practical studies. They also must be able to work independently and communicate their ideas orally and in writing.

Employment Outlook

Employment of geographers is expected to grow faster than the average for all occupations through the mid-1980's. However, most openings are likely to result from deaths, retirements, and other separations from the labor force.

Little growth is anticipated in college and university teaching, the traditional employer of many highly qualified geographers; as a result, many such geographers may seek nonacademic positions. Many opportunities are becoming available in the fields of health services planning and environmental management and planning, including such areas as land and water resources planning and flood management. Significant growth in the number of jobs requiring knowledge of remote sensing, cartography, and climatology also is expected. The Federal Government will need additional personnel to work in programs such as health planning, regional development, environmental quality, and intelligence. Employment of geographers in State and local government is expected to expand, particularly in areas such as health planning, conservation, environmental quality, highway planning, and city, community, and regional planning and development. Private industry is expected to hire increasing numbers of geographers for market research and location analysis.

The employment outlook for geographers with the Ph. D. is expected to be favorable through the mid-1980's for research and administrative positions in government, industry, research organizations, and consulting firms. Ph. D. 's may face competition for academic positions, although those graduating from high-ranking universities should have an advantage. Those with the master's degree are likely to face competition for academic positions, but should have good opportunites for planning and marketing positions in government and industry.

Graduates with a bachelor's degree in geography are expected to face competition for jobs as geographers. Some may find jobs as cartographers, climatologists, or intelligence analysts, while many of these degree holders may find employment in government and industry as management trainees, research assistants, or administrative assistants. Others may obtain employment as research or teaching assistants in educational institutions while studying for advanced degrees. Some bachelor's degree holders teach at the high school level, although in some States the master's degree is becoming essential for high school teaching positions. Others earn library science degrees and become map librarians.

Earnings and Working Conditions

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to an Association of American Geographers survey, Ph. D.'s with no teaching experience earned starting salaries between $12,000 and $14,000 for the academic year 1975-76, while the average salary of geographers employed in colleges and universities was

$19,000. Salaries of geographers in planning positions in business and industry are comparable to those in the Federal Government.

Geographers in educational institutions usually have an opportunity to earn income from other sources, such as consulting work, special research, and publication of books and articles. In general, salaries of experienced geographers are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, geographers in the Federal Government with the bachelor's degree and no experience started at $9,303 or $11,523 a year in 1977, depending on their college achievement. Those with a master's degree started at $14,097 a year, and those with the Ph. D. at $17,056. Geographers and cartographers in the Federal Government averaged around $21,100 in 1977.

Geographers sometimes must do field work in primitive regions of the world, requiring an ability to adapt to different social and cultural environments.

Sources of Additional Information

For additional information on careers and job openings for geographers, and on schools offering various programs in geography, contact:

Association of American Geographers, 1710 16th St. NW., Washington, D.C. 20009.

HISTORIANS

(D.O.T. 052.038 and .088)

Nature of the Work

History is the record of past events, institutions, ideas, and people. Historians describe and analyze the past through writing, teaching, and research. They relate their knowledge of the past to current events in an effort to explain the present.

Historians may specialize in the history of a specific country or area, or era—ancient, medieval, or modern. They also may specialize in the history of a field, such as economics, medicine and disease, philosophy, religion, science, culture, military affairs, the labor movement, art, or architecture. Other specialties are concerned with historic preservation, women, business, archives, quantitative analysis, and the relationship between technological and other aspects of historical development.

In this country, many historians specialize in the social or political history of either the United States or modern Europe; however, a growing number are specializing in African, Latin American, Asian, or Near Eastern history. Some historians specialize in phases of a larger historical field, such as the American Civil War.

Most historians work in colleges and universities and are primarily concerned with teaching. They often lecture, write, and do research outside the academic setting. Other historians employed in colleges and universities are involved in research and development, administration, and other non-teaching activities. Some specialists, called *archivists*, work for museums, special libraries, historical societies, and other organizations. They collect historical documents and objects, prepare historical exhibits, and edit and classify historical materials for use in research and other activities. A growing number of historians are concerned with the interpretation and preservation of historic buildings, treasures, documents, and other items. A few serve as consultants to editors, publishers, and producers of materials for radio, television, and motion pictures. Some historians are administrators in government or researchers who prepare studies, articles, and books on their findings.

Colleges and universities employ about 70 percent of all historians.

Places of Employment

An estimated 22,500 persons worked as professional historians in 1976, excluding those teaching in secondary schools. Colleges and universities employ about seventy percent of all historians. Historians also work in archives, libraries, museums, research organizations, historical societies, publishing firms, large corporations, and government agencies. Historians employed in the Federal Government work principally in the National Archives, Smithsonian Institution, or in the Departments of Defense, Interior, and State. Other Federal agencies that employ historians include the National Aeronautics and Space Administration, Central Intelligence Agency, National Security Agency, and the Departments of Agriculture, Commerce, Transportation, and Health, Education and Welfare. A small but growing number work for State and local governments.

Historians are employed in virtually all U.S. institutions of higher education. Most historians who work for the Federal Government are in Washington, D.C. Historians in other types of employment usually work in localities having museums or libraries with collections adequate for historical research.

Training, Other Qualifications, and Advancement

Graduate education usually is necessary for employment as a historian. A master's degree in history is the minimum requirement for the position of college instructor. A Ph. D. degree usually is required for a professorship and for administrative positions, and almost always is necessary to gain tenure.

While historians in the Federal Government generally must have 24

semester hours in history, requirements may vary for certain specialists such as archivists, who usually must have 30 hours of graduate work in history. Most historians in the Federal Government and in nonprofit organizations have Ph. D. degrees, or their equivalent in training and experience.

Although a bachelor's degree with a major in history is sufficient training for some beginning jobs in government— either Federal, State, or local— advancement opportunities may be limited for persons without at least a master's and preferably a Ph. D. degree in history. Since beginning jobs are likely to be concerned with collection and preservation of historical data, a knowledge of archival work is helpful.

Training for historians is available in many colleges and universities. Over 1,250 schools offer programs for the bachelor's degree; about 440, the master's; and about 145, doctorates.

History curriculums in the Nation's colleges and universities are varied; however, each basically provides training in research methods, writing, and speaking. These are the basic skills essential for historians in all positions. Quantitative methods of analysis, including statistical and computer techniques, are increasingly important for historians; many college programs include them. Most doctoral candidates must exhibit competence in a foreign language.

Historians spend a great deal of time studying, doing research, writing papers and reports, and giving lectures and presentations. Therefore, they must possess analytical skills and the ability to communicate their ideas effectively, orally and in writing. The ability to work both independently and as part of a group also is essential.

Employment Outlook

Employment of historians is expected to grow more slowly than the average for all occupations through the mid-1980's. Job openings will result chiefly from deaths, retirements, and other separations from the labor force.

Only a small number of historians will be needed to fill positions in colleges and universities, junior colleges, libraries, archives, museums, secondary schools, research organizations, publishing firms, and government agencies. Persons with training in historical specialties such as historic preservation and business history, in addition to those well-trained in quantitative methods in historical research are expected to have the most favorable job opportunities. Those who are able to teach several areas of history should have the best opportunities for jobs in colleges and universities.

Although information is limited on patterns of entry to the field, it is clear that the number of persons seeking to enter the occupation will greatly exceed available positions. As a result, historians with a Ph. D. are expected to face keen competition for positions through the mid-1980's. Those graduating from prestigious universities should have some advantage in this highly competitive situation. Since academic institutions are the traditional employers of many highly qualified historians and competition for these jobs is expected to be particularly keen, many Ph. D.'s are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. Persons with the master's degree in history will encounter very keen competition for jobs as historians. However, some of them will find teaching positions in community and junior colleges or high schools; such jobs may have State certification requirements.

People with a bachelor's degree in history are likely to find very limited opportunities for employment as professional historians. However, an undergraduate major in history provides an excellent background for some jobs in international relations, journalism, and other areas, and for continuing education in law, business adminstration, and related disciplines. Many graduates will find jobs in secondary schools or in government, business, and industry as management or sales trainees, or as research or administrative assistants.

Earnings

According to the 1975-76 College Placement Council Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to information from the American Historical Association, large public colleges and universities offered starting salaries ranging from about $13-$15,000 for academic year 1975-76. Smaller public and private academic institutions generally offered lower salaries. Full professors and top administrators may earn $25-$30,000 a year or more. In general, salaries of experienced historians are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, historians having a bachelor's degree could start at $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. Starting salaries for those having a master's degree were $14,097 a year, and for those having a Ph. D., $17,056. Historians and archivists in the Federal Government averaged around $22,400 a year in 1977.

Many historians, particularly those in college teaching, supplement their income by teaching summer classes, writing books or articles, or giving lectures.

Sources of Additional Information

Additional information on careers and job openings for historians, and on schools offering various programs in history, is available from:

American Historical Association, 400 A St. SE., Washington, D.C. 20003.

For information on careers and schools offering programs in historic preservation, contact:

National Trust for Historic Preservation, 740 Jackson Place, N.W., Washington, D.C. 20006.

Additional information on nonteaching opportunities for historians is available from:

Organization of American Historians, Indiana University, 112 North Bryan St., Bloomington, Ind. 47401.

POLITICAL SCIENTISTS

(D.O.T. 051.088)

Nature of the Work

Political scientists study the functions and workings of governments. Many of them specialize in a general area of political science including political theory, U.S. political institutions and processes, comparative political institutions and processes, or international relations and organizations. Some specialize in a particular type of political institution or in the politics of a specific era.

Most political scientists teach in colleges and universities where they may combine research, consultation, or administrative duties with teaching. Some are primarily researchers who survey public opinion on political questions for private research organizations, or study proposed legislation for Federal, State, and municipal governments, legislative reference bureaus, or congressional staffs and committees. Others analyze the operations of government agencies, specialize in foreign affairs, or do administrative or research work for either government or nongovernment organizations. Some political scientists serve as consultants to political groups or business firms.

Some political scientists survey public opinion on political questions for private research organizations.

Places of Employment

About 14,000 persons worked as political scientists in 1976, excluding those teaching in secondary schools. About four-fifths work in colleges and universities. Most of the remainder work in government, management consulting firms, political organizations, research organizations, civic and taxpayers associations, and large business firms.

Political scientists can be found in nearly every college or university town since courses in government and political science are taught in almost all institutions of higher education. Since the national headquarters of many associations, unions, and other organizations are located in Washington, D.C., this area attracts a sizable number of political scientists in research or policy jobs. The Federal Government employs political scientists both domestically and abroad. Those on overseas assignment work primarily for agencies of the U.S. Department of State, such as the Foreign Service, and the U.S. Agency for International Development. Other employing agencies in-

clude the U.S. Information Agency, Energy Research and Development Agency, Central Intelligence Agency, and the Departments of Defense, Treasury, Justice, and Commerce. Political scientists in the Federal Government primarily are concerned with foreign affairs, international relations, and intelligence. Those employed in State and local government often are concerned with the administration of housing, economic development, transportation, environmental protection, and health programs. Political scientists in the business world may deal with marketing, personnel, advertising, public relations, banking, finance, and consumer affairs.

Training, Other Qualifications, and Advancement

Graduate training generally is required for employment as a political scientist. Completion of all the requirements for the Ph. D. degree is becoming the prerequisite for appointment to academic positions, and almost always is required for one to gain a professorship and tenure. The Ph. D. also is helpful for advancement in government, industry, and other nonacademic areas.

College graduates with a master's degree can qualify for various administrative and research positions in government, industry, and nonprofit research or civic organizations. A master's degree in international relations, foreign service, or area study (for example, Soviet Government) is helpful in obtaining positions in Federal Government agencies concerned with foreign affairs. Intelligence, foreign affairs, and international relations specialists in the Federal Government generally must have 24 semester hours in political science, history, economics, or related fields.

People with a bachelor's degree in political science may qualify as trainees in such areas as management, research, administration, sales, and law enforcement. Many students with bachelor's degrees in political science go on to study law, journalism, or some specialized or related branch of political science, such as public administration and international relations.

In 1976, about 1,100 colleges and universities offered a bachelor's degree in political science, around 270 had master's programs, and about 115 had doctoral programs. Many colleges and universities offer field training and internships that provide experience in government work or teaching.

Undergraduate programs in political science include courses in the principles of government and politics, State and local government, comparative studies, political theory, foreign policy, public administration and policy, political behavior, constitutional, administrative, and international law, and many other offerings. Other specialized political science courses and seminars deal with the problems of detente, politics of growth and technology, politics of health, legal status of women, political warfare in the age of nuclear destruction, and political culture and the psychological processes of death. A growing number of programs at both the undergraduate and graduate levels offer courses in quantitative and statistical methods, including the use of computers.

Graduate students may specialize in American politics, comparative politics, international politics, political behavior, political theory, public administration, urban affairs, public policy, and other areas. Doctoral candidates often must exhibit competence in one or more foreign languages and quantitative research techniques.

Persons planning careers as political scientists should like to work with details. They must be objective and able to work independently or as part of a team. Ability to express themselves clearly, orally and in writing, is important to political scientists.

Employment Outlook

Employment of political scientists is expected to increase more slowly than the average for all occupations through the mid-1980's. Most jobs openings will result from deaths, retirements, and other separations from the labor force. The largest area of employment will continue to be in college and university teaching.

The number of persons who graduate with advanced degrees in political science will greatly exceed available job openings through 1985. As a result, those with a Ph. D. face stiff competition for positions through the mid-1980's, although Ph. D.'s from prestigious universities are likely to have an advantage. Many Ph. D.'s are expected to accept part-time, temporary assignments as instructors with little or no hope of gaining tenure. Graduates trained in quantitative methods of research, American Government, public administration, or policy science should have an advantage for both academic and nonteaching positions. Those with knowledge of economic theory, transportation, health care delivery systems, and environmental questions may be in particular demand. Graduates seeking to enter the foreign service are expected to face very stiff competition. Master's degree holders will face very keen competition finding academic positions, but those with specialized training in areas such as policy science or public administration may find jobs in Federal, State and local government, research bureaus, political organizations, and business firms.

New graduates with the bachelor's degree are expected to find few opportunities for jobs as professional political scientists. However, many of these graduates are expected to accept positions as trainees in government, business, and industry. For those planning to continue their studies in law, foreign affairs, journalism, and related fields, political science provides an excellent background. Some new graduates who meet State certification requirements will be able to enter high school teaching.

Earnings

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

According to an American Political Science Association Survey, the median beginning salaries for new

faculty members during 1975-76 were $12,300 for Ph. D.s and $11,200 for those without a Ph. D. The median annual salaries of political scientists employed in educational institutions in 1975-76 were: $22,000 for full professors; $17,000 for associate professors; $13,500 for assistant professors; and $11,500 for lecturers and instructors. In general, salaries of experienced political scientists are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for those with a bachelor's degree was $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. Starting salaries for those with a master's degree were $14,097 a year, and for those with a Ph. D., $17,056. Intelligence, foreign affairs, and international relations specialists in the Federal Government averaged around $25,300 in 1977.

Some political scientists, particularly those in college teaching, supplement their income by teaching summer courses or consulting.

Sources of Additional Information

Additional information on careers, job openings, and schools offering various graduate programs in political science and related fields is available from:

American Political Science Association, 1527 New Hampshire Ave. NW., Washington, D.C. 20036.

PSYCHOLOGISTS

(D.O.T. 045.088 and .108)

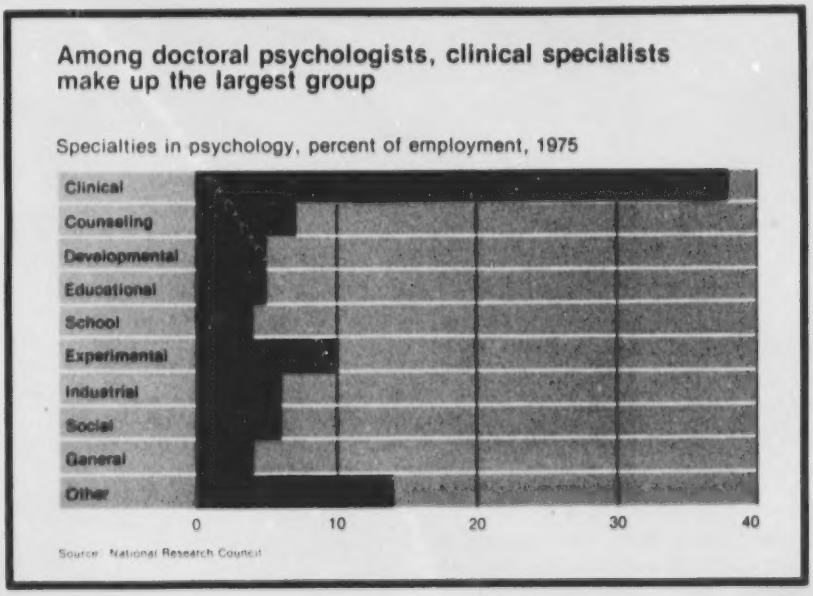
Nature of the Work

Psychologists study the behavior of individuals and groups in order to understand and explain their actions. During their work, they may be concerned with the effect of one member's emotional stress upon a family, causes of low morale at work, or the most effective way of dealing with terrorists. Some engage in teaching, research, and administrative activities in colleges and universities; others provide counseling services, plan and conduct training programs for employees, conduct research, advise on psychological methods and theories, or administer psychology programs in hospitals, clinics, or research laboratories. Many psychologists combine several of these activities.

Psychologists gather information about the capacities, interests, and behavior of people in various ways. They interview individuals, develop and administer tests and rating scales, study personal histories, and conduct controlled experiments. Also, psychologists often design and conduct surveys.

Psychologists specialize in a wide variety of areas. *Experimental psychologists* study behavior processes and work with human beings and lower animals such as rats, monkeys, and pigeons; prominent areas of experimental research include motivation, learning and retention, sensory and perceptual processes, and genetic and neurological factors in behavior. *Developmental psychologists* study the patterns and causes of behavioral change as people progress through life; some concern themselves with the origins of human behavior during childhood, while others study changes that take place during maturity and old age. *Personality psychologists* study human nature, individual differences, and the ways in which those differences develop. *Social psychologists* examine people's interactions with others and with the social environment; prominent areas of study include group behavior, leadership, and dependency relationships. Psychologists in *evaluation research* study social programs and their effects and recommend improvements as a result of increased understanding. *Environmental psychologists* study the influences of environments on people, and their perceptions of these environments. *Population psychologists* study demography's relation to personal and social behavior. *Comparative psychologists* compare the behavior of different animals, including man. *Physiological psychologists* study the relationship of behavior to the biological functions of the body. Psychologists in the field of *psychometrics* develop and apply procedures for measuring psychological variables.

Psychologists often combine several areas in their specialty. *Clinical psychologists*, the largest specialty, generally work in mental hospitals or



clinics, or maintain their own practices. They may help the mentally or emotionally disturbed readjust to life with altered physical capabilities. They interview patients, give diagnostic tests, provide individual, family, and group psychotherapy, and design and carry through behavior modification programs. *Counseling psychologists* use several techniques, including interviewing and testing, to help people with problems of everyday living—personal, social, educational, or vocational. *Educational psychologists* study psychological processes as related to applied problems in education. *School psychologists* diagnose educational problems, facilitate school adjustment, and help solve learning and social problems in the schools. *Industrial and organizational psychologists* engage in personnel research, policy, and planning, training and development, psychological test research, counseling, and organizational development and analysis, among other activities. *Engineering psychologists* develop and improve human-machine systems, military equipment, and industrial products. *Community psychologists* apply psychological knowledge to problems of community life. *Consumer psychologists* study the psychological factors that determine an individual's behavior as a consumer of goods and services.

Places of Employment

About 90,000 people, excluding secondary school teachers, worked as psychologists in 1976. About one-half worked in educational institutions, primarily colleges and universities (including medical schools), either as teachers, researchers, administrators, or counselors.

The second largest group of psychologists work in hospitals, clinics, rehabilitation centers, and other health facilities, while many others work for Federal, State, or local government agencies. They typically administer and interpret intelligence, interest, and aptitude tests; diagnose and treat mental disorders; and conduct educational, vocational, and personal adjustment counseling. Federal agencies that employ the most psychologists are the Veterans Administration, the Department of Defense, and the Public Health Service. Other employing agencies include the Departments of Justice, Commerce, Treasury, Interior, Labor, and Transportation, the Civil Service Commission, the National Aeronautical and Space Administration, and the Environmental Protection Agency.

Psychologists also are employed in correctional institutions, research organizations, and business firms. Some are in independent practice or work as consultants.

Training, Other Qualifications, and Advancement

A doctoral degree almost always is the minimum requirement for employment as a psychologist. The degree is needed for many entrance positions and is becoming increasingly important for advancement. People with doctorates in psychology qualify for the more responsible research, clinical, and counseling positions, as well as for teaching positions in colleges and universities and administrative posts in Federal and State programs. The doctoral degree is necessary to gain academic tenure, a process that is becoming more difficult and taking longer than in the past.

People with a master's degree in psychology can qualify as psychological assistants, administering and interpreting some kinds of psychological tests. Working under the supervision of psychologists, they may collect and analyze data, conduct experiments, or perform administrative duties. They also qualify for certain counseling jobs or—if they have previous teaching experience—may be hired as school psychologists or counselors. (See the statements on school counselors and rehabilitation counselors.)

People with a bachelor's degree in psychology may work directly under psychologists and other professionals in community mental health centers, vocational rehabilitation offices, and correctional programs; as research or administrative assistants; as trainees in government or business; or—provided they meet State certification requirements—as high school teachers.

In the Federal Government, some positions are filled at the entrance grade with candidates having at least 24 semester hours in psychology and one course in statistics. Most positions, however, are filled at a higher grade. Clinical psychologists generally must have completed the Ph. D. requirements and have served an internship; counseling psychologists need 2 years of graduate study in counseling and 1 year of counseling experience.

At least 1 year of full-time graduate study is needed to earn a master's degree in psychology. An additional 3 to 5 years of graduate work usually are required for a Ph. D. In clinical or counseling psychology, the requirements for the Ph. D. degree generally include an additional year or more of internship or supervised experience. Doctoral candidates at some universities must exhibit competence in a foreign language. Some gain postdoctoral appointments for special study and research.

The Ph. D. degree culminates in a dissertation based on original research which contributes to psychological knowledge. Another professional degree, the Psy. D. (Doctor of Psychology), is based on practical work and examinations rather than a dissertation.

Some universities require graduate school applicants in psychology to have a major in that field. Others prefer only basic psychology with courses in the biological, physical, and social sciences, statistics, and mathematics. Some persons trained in other fields such as social work, counseling, and education find graduate education in psychology useful.

Competition for admission into graduate psychology programs is keen. Only the most highly qualified applicants can expect to be admitted to graduate study.

Over 1,100 colleges and universities offer a bachelor's degree program in psychology; about 325, a master's; about 165, a Ph. D.; and about 20, a Psy. D. The American Psychological Association (APA) presently accredits doctoral training programs in clinical, counseling, and school psychology. In 1976, over 100 colleges and universities offered fully

approved programs in clinical psychology; over 20, in counseling psychology; and fewer than 10, in school psychology. APA also has approved about 120 facilities offering internships for doctoral training in clinical and counseling psychology.

Although financial aid is becoming increasingly difficult to obtain, some graduate students may receive fellowships, scholarships, or part-time employment. The Veterans Administration offers a number of predoctoral traineeships to students while they work as interns in VA hospitals, clinics, and related training agencies. The National Science Foundation, Department of Health, Education, and Welfare, various branches of the Armed Forces, and many other organizations and foundations also provide fellowships, grants, and loans. However, the present trend at the Federal level is to provide low-interest loans rather than fellowships and grants.

Psychologists who want to enter independent practice must meet certification or licensing requirements. In 1976, 49 States and the District of Columbia had these requirements. Licensing laws vary by State, but generally require a doctorate in psychology, 2 years of professional experience, and an examination.

The American Board of Professional Psychology awards diplomas in clinical, counseling, industrial and organizational, and school psychology. Candidates generally need a doctorate in psychology, 5 years of qualifying experience, and professional endorsements, and also must pass an examination.

People pursuing a career in psychology must be emotionally stable, mature, and able to deal effectively with people. Sensitivity, patience, and a genuine interest in others are particularly important for work in clincal and counseling psychology. Research psychologists should be able to do detailed and independent work; verbal and writing skills are necessary to communicate research findings.

Sensitivity, patience, and a genuine interest in others are particularly important for work in clinical and counseling psychology.

Employment Outlook

Employment of psychologists is expected to grow faster than the average for all occupations through the mid-1980's. In addition to employment growth, some openings will result from deaths, retirements, and other separations from the labor force.

Several factors should help maintain a strong demand for psychologists. First is increased public concern for the development of human resources, particularly among the aging and minority groups. Growing awareness of the need for testing and counseling children also should increase the demand. Federal legislation emphasizing good health rather than treatment of illness may produce new roles for psychologists in preventive and therapeutic situations and in group practice. Inclusion of psychological services in a future national health insurance program also may heighten demand.

Other openings are likely to occur as psychologists move into new fields such as technology assessment—the study of the effects of technological advances in areas such as agriculture, energy, the environment, and the conservation and use of natural resources. In addition, psychologists are becoming involved in program evaluation in such fields as education, military service, and law enforcement. Government agencies, business, and industry also are making increased use of the services that psychologists can provide in counseling, employee assessment and training, and market research.

A doctorate is increasingly necessary for those wishing to enter the field. However, the growing number of doctoral degrees awarded in psychology each year means that new Ph. D.'s will face increasing competition for jobs through 1985, particularly academic positions in large colleges and universities. Those willing to work in smaller and newer institutions should have better employment prospects.

Persons holding doctoral degrees from prestigious universities should have an advantage on the job market.

Those with doctorates in applied areas such as clincial, counseling, and industrial or organizational psychology are expected to have more favorable job prospects than those trained in traditional academic specialties such as experimental, physiological, and comparative psychology.

As more and more people earn doctorates in psychology, master's degree holders will face increasingly keen competition, particularly for research or teaching jobs in colleges and universities. Opportunities are likely to be best in industry, government, and human service organizations, all of which will have some jobs for persons with training in applied areas including evaluation research.

Bachelor's degree holders will be able to enter the field only as assistants or trainees, working under the direct supervision of psychologists and other professionals. However, for persons who wish to continue their education in fields such as law, medicine, social work, sociology, counseling, recreation, gerontology, or related disciplines, psychology provides an excellent undergraduate background.

Earnings and Working Conditions

In 1975, the median starting salary for psychologists holding a master's degree was about $11,000 a year, according to the American Psychological Association. The median beginning salary for those holding a doctorate was about $13,000 for 9-month academic jobs and between $16,000 and $17,000 for 12-month jobs.

According to a 1975 survey by the National Research Council, the median annual salary for all doctoral psychologists was about $22,000. In educational institutions, the median was about $20,900; in the Federal Government, about $26,600; in State and local government, about $21,500; in hospitals and clincs, about $21,400; in nonprofit organizations, about $24,600; and in business and industry, about $30,600. Ph. D. psychologists in private practice and in applied specialties generally have higher earnings than other psychologists. In general, salaries of experienced psychologists are much higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for psychologists having a bachelor's degree was $9,303 or $11,523 a year in 1977; counseling psychologists with a master's degree and 1 year of counseling experience started at $14,097; clinical psychologists having a Ph. D. degree and 1 year of internship started at $17,056. The average salary for psychologists in the Federal Government was about $25,200 a year in 1977.

Psychologists in colleges and universities receive the same benefits as other faculty members—sabbatical leaves of absence, life and health insurance, and retirement benefits. Working hours are generally flexible, but often entail evening work with individual students or groups. Clinical and counseling psychologists often work in the evenings since their patients sometimes are unable to leave their jobs or school during the day.

Sources of Additional Information

For information on career opportunities and job openings for psychologists, admission and degree requirements in colleges and universities offering graduate programs in psychology, accreditation, certification or licensure requirements, and financial assistance for graduate students in psychology, contact:

American Psychological Association, Educational Affairs Office, 1200 17th St. NW., Washington, D.C. 20036.

Information on traineeships and fellowships is available from colleges and universities that have graduate psychology departments.

SOCIOLOGISTS

(D.O.T. 054.088)

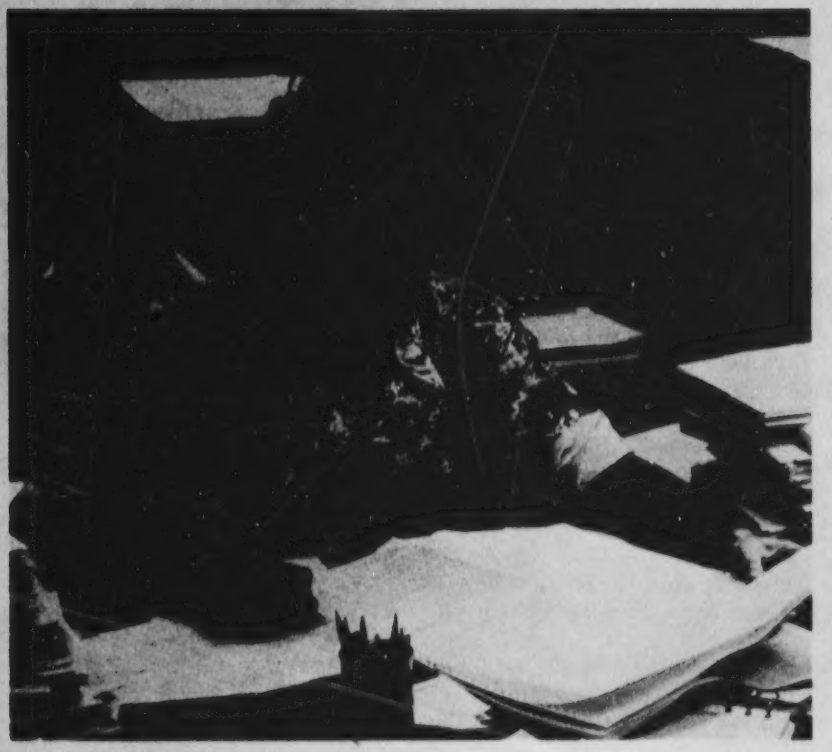
Nature of the Work

Sociologists study human society and social behavior by examining the groups that humans form. These groups include families, tribes, communities, and governments, along with a variety of social, religious, political, business, and other organizations. Sociologists study the behavior and interaction of groups; trace their origin and growth; and analyze the influence of group activities on individual members.

Some sociologists concern themselves primarily with the characteristics of social groups and institutions. Others are more interested in the ways individuals are affected by groups to which they belong.

Important fields of specialization for sociologists include social organization, social pathology and psychology, rural or urban sociology, criminology and penology, demography, industrial sociology, and medical sociology—the study of social factors that affect mental and public health. Increasingly, sociologists are finding opportunities to apply their professional knowledge and methods in areas of practice as diverse as intergroup relations, family counseling, public opinion analysis, law, education, public relations, regional and community planning, and environmental planning.

Most sociologists are college and university teachers; some are involved in research, writing, administration, and other nonteaching activities. Sociological research, like other kinds of social science research, involves collecting information, preparing case studies, testing, and conducting surveys and laboratory experiments. Increasingly, sociologists apply advanced statistical and computer techniques in their research. The results of sociological research often aid educators, lawmakers, administrators, and other officials interested in local, national, or international social problems. Sociologists work closely with members of other professions including psychologists, physicians, economists,



Sociologists spend a great deal of their time in study and research.

political scientists, anthropologists, and social workers.

Some sociologists supervise the operation of social service agencies such as family and marriage clinics. Others, acting as consultants, advise on diverse problems such as the management of hospitals for the mentally ill, the rehabilitation of juvenile delinquents, or the development of effective advertising programs to promote public interest in particular products such as television sets or cars.

Places of Employment

About 19,000 persons worked as sociologists in 1976, excluding those teaching in secondary schools.

Colleges and universities employ about four-fifths of all sociologists. A number work for Federal, State, local, or international government agencies, and are professionally concerned with such subjects as poverty, welfare services and other public assistance programs, population problems, social rehabilitation, community development, and environmental impact studies. Some work in private industry, research firms, management consulting firms, welfare or other nonprofit organizations, or else are self-employed. Some work in positions that require training in sociology and related disciplines, but are not classified as professional sociologists. Related fields include social work, recreation, and public health.

Since sociology is taught in most institutions of higher learning, sociologists may be found in nearly all college communities. They are most heavily concentrated, however, in large colleges and universities that offer graduate training in sociology and opportunities for research.

Training, Other Qualifications, and Advancement

A master's degree and a major in sociology usually is the minimum requirement for employment as a sociologist. The Ph. D. degree is essential for appointment as a professor and for tenure in almost all colleges or universities. The Ph. D. commonly is required for directors of major research projects, important administrative positions, or consultants.

Sociologists with master's degrees can qualify for many administrative and research positions, provided they have sufficient training in research, statistical, and computer methods. Advancement from these to supervisory positions in both public and private agencies generally is based on experience. Sociologists with master's degrees may qualify for some college instructorships. Most colleges, however, appoint as instructors only people who have training beyond the master's level—frequently the completion of all requirements for the Ph. D. degree except the doctoral dissertation. Outstanding graduate students may get teaching or research assistantships that provide both financial aid and valuable experience.

Bachelor's degree holders in sociology may get jobs as interviewers or as administrative or research assistants. Many work as social workers, counselors, or recreation workers in public and private welfare agencies. Sociology majors who have sufficient training in statistics may get positions as beginning analysts or statisticians.

Over 1,200 colleges and universities offer bachelor's degree programs in sociology; about 145 offer master's degrees; and about 125 have doctoral programs. Sociology departments offer a wide variety of courses including sociological theory, statistics and quantitative methods, dynamics of social interaction, sex roles, population, social stratification, social control, small group analysis, rural-urban relations, formal and complex organizations, sociology of religion, law, the arts, war, politics, education, occupations and professions, and mental health, in addition to many others.

In the Federal Government, candidates generally must have 24 semester hours in sociology, with course work including theory and methods of social research. However, since positions as professional sociologists are quite limited, advanced study in the field is highly recommended.

The choice of a graduate school is important for people who want to become sociologists. Students should select schools that have adequate re-

search facilities and offer appropriate areas of specialization such as theory, social psychology, or quantitative methods. Opportunities to gain practical research experience also may be available, and sociology departments frequently aid in the placement of graduates.

Sociologists spend a great deal of their time in study and research. They must be able to communicate effectively, both orally and in writing. The ability to work as part of a group as well as independently is important.

Employment Outlook

Employment of sociologists is expected to increase more slowly than the average for all occupations through the mid-1980's. Most openings will result from deaths, retirements, and other separations from the labor force. Some academic openings will result from the growing trend to include sociology courses in the curriculums of other professions, such as medicine, law, business administration and management, and education. Demand in the nonteaching area will center around public and private programs dealing with the development of human resources, particularly those designed to cope with social and welfare problems.

The number of persons who will graduate with advanced degrees in sociology is likely to greatly exceed available job openings. Graduates with a Ph. D. face increasing competition for academic positions, although those with degrees from prestigious institutions may have an advantage in securing a teaching job. Some Ph. D.'s may accept temporary, part-time positions as instructors. Others may find research and administrative positions in government, research organizations, and consulting firms. Graduates with training in business administration including management and accounting should have the most favorable job opportunities in business and industry. Persons with a master's degree will continue to face very keen competition for academic positions, although some jobs may be available in junior and community colleges. Some may find research and administrative jobs in government, research firms, and private industry.

Bachelor's degree holders are expected to find very limited opportunities as professional sociologists. However, many graduates are expected to gain positions as trainees in government, business, and industry. For those planning to continue their studies in law, journalism, social work, recreation, counseling, and other related disciplines, sociology provides an excellent background. Some who meet State certification requirements may enter high school teaching.

Sociologists well trained in quantitative research methods, survey methods, advanced statistics, and computer science will have the widest choice of jobs. Demand is expected to be particularly strong for research personnel to work in such areas as urban studies, ethnic studies, race relations, deviant behavior, community development, population analysis, medical sociology, and the sociology of law, work, and education.

Earnings and Working Conditions

According to the 1975-76 College Placement Council Salary Survey, bachelor's degree candidates in the social sciences received offers averaging around $10,000 a year; master's degree candidates in the social sciences, around $12,000.

Salaries of sociologists working in educational institutions and non-academic settings are comparable to those for other social scientists. In general, salaries of experienced sociologists are higher than the average for all nonsupervisory workers in private industry, except farming.

The Civil Service Commission recognizes education and experience in certifying applicants for entry level positions in the Federal Government. In general, the entrance salary for sociologists with a bachelor's degree was $9,303 or $11,523 a year in 1977, depending upon the applicant's academic record. The starting salary for those with a master's degree was $14,097 a year, and for those with a Ph. D., $17,056. Sociologists in the Federal Government work primarily in the Departments of Health, Education, and Welfare; Defense; Agriculture; Interior; Commerce; Transportation; and Housing and Urban Development, as well as the Veterans Administration and Environmental Protection Agency. They averaged around $23,800 in 1977.

In general, sociologists with the Ph. D. degree earn substantially higher salaries than those with master's degrees. Many sociologists, particularly those employed by colleges and universities for the academic year (September to June), supplement their regular salaries with earnings from other sources, such as summer teaching and consulting work.

Sources of Additional Information

Additional information on careers, employment opportunities, and graduate departments of sociology is available from:

The American Sociological Association, 1722 N St., NW., Washington, D.C. 20036.

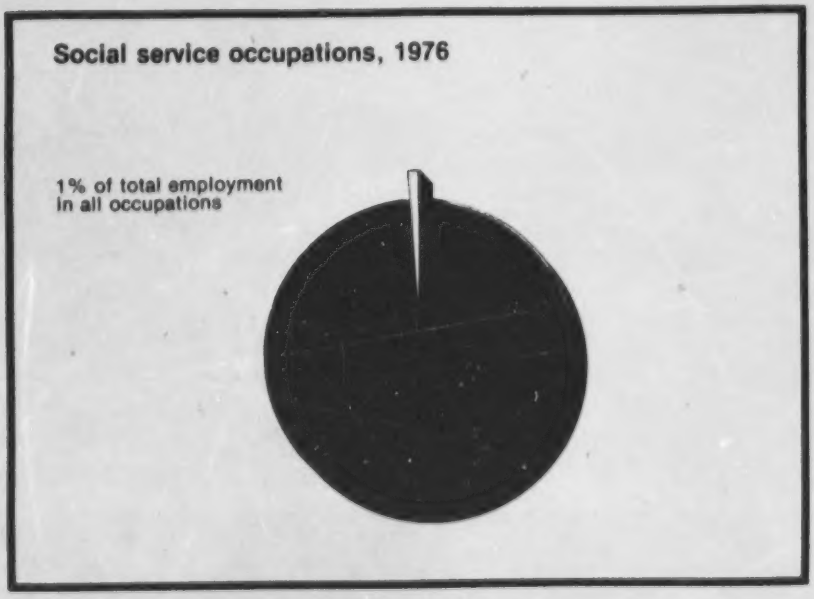
SOCIAL SERVICE OCCUPATIONS

Workers in social service occupations help people in a number of different ways. School counselors help students develop educational plans that fit the student's abilities, interests, and career potential. Employment counselors guide people of all ages in planning careers and finding jobs. Their advice helps clients select an appropriate field of endeavor, and then prepare for it. Rehabilitation counselors advise people with physical, mental, or social disabilities. These counselors help handicapped persons understand what adjustments are needed in their personal lives and vocational plans in order to achieve a satisfactory lifestyle. College career planning and placement counselors help college students choose a career and advise them on the kind of training or experience that will best help them find a job.

Members of the clergy, whether Rabbis, Protestant Ministers, or Catholic Priests, counsel people of their faith and provide spiritual leadership within their communities. They enable people to worship according to the dictates of their consciences. As spiritual leaders, members of the clergy are widely regarded as models for moral and ethical conduct. They frequently counsel people who have problems in their jobs, homes, schools, or social relationships; often, these are emotional problems. In fact, they deal in such delicate personal and emotional areas that the law provides that they need not disclose the nature of their communications with their congregants. These are privileged communications. The work of the clergy is never done, and its importance cannot be overstated.

Other occupations involve social service as well. Cooperative extension service workers deal with people who live in rural areas; they do educational work in such areas as agriculture and home economics, and encourage youth activities and community development. Home economists provide training and technical assistance in areas that make everyday life more comfortable and liveable—consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and family development and relations. Park, recreation, and leisure service workers plan, organize, and direct activities that help people of various ages and socioeconomic groups enjoy their nonworking hours. Social service aides assist rehabilitation counselors, social workers, and other professionals. Social workers help individuals, families, groups, and communities in solving their problems so that they can live more effectively in society.

People in social service occupations become closely involved with their clients' lives, and the services they provide can have farreaching effects. Advice on schools, jobs, careers, rehabilitation, or emotional and family problems may lead an individual to make fundamental decisions about his or her future. Suggestions made by a counselor or social worker may shape a client's entire future. Members of the clergy in particular may become involved in the most intimate details of their congregants' lives. For these reasons, a genuine concern for people and a desire to help them improve their lives are important for anyone considering a career in the social service field. Patience, tact, sensitivity, and compassion are necessary personal qualities. Moreover, people in social service occupations must have appropriate training and should be dedicated to high standards of professionalism. Anything less may



prove disastrous to the people being served.

In general, knowledge of the particular social service field is gained through college and graduate education. Often, professional education includes an internship, or period of work experience, that enables the student to learn how to apply classroom knowledge to real life situations.

COUNSELING OCCUPATIONS

At some point in their lives, most people seek advice or assistance for personal, education, or vocational problems. These problems may be relatively minor, such as a conflict in a student's class schedule, or may involve serious emotional or physical disabilities. Regardless of the problem, counselors often are the ones to whom people turn for help.

Counselors may specialize in a specific area and work setting. Some deal primarily with school children, while others work only with adults. Some counselors are trained to assist in vocational planning and may work for State or private, nonprofit agencies. Whatever the area of specialization, counselors help people understand themselves—their capabilities and potential—so that they can make and carry out decisions and plans for a satisfying and productive life.

This chapter covers four counseling specialties: school; rehabilitation; employment; and college career planning and placement.

School counselors are the largest counseling group. They are primarily concerned with the personal, social, and educational development of students.

Rehabilitation counselors help persons with physical, mental, or social handicaps to become productive individuals.

Employment counselors counsel persons—the unemployed or unskilled, for example—who cannot find a job and/or have problems in career choice and planning.

College career planning and placement counselors help college students examine their own interests, abilities, and goals; explore career alternatives; and make and follow through with a career choice.

Persons who want to enter the counseling field must be interested in helping people and have an ability to understand their behavior. A pleasant but strong personality that instills confidence in clients is desirable. Counselors also must be patient, sensitive to the needs of others, and able to communicate orally as well as in writing.

In addition, many psychologists, social workers, and college student personnel workers also do counseling. These and other fields which entail some counseling such as teaching, health, law, religion, and personnel, are described elsewhere in the *Handbook*.

SCHOOL COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Uncertainty about career choice, learning disabilities, or an unhappy home life are typical problems that many students face. Usually these problems cannot be solved by the student alone; professional assistance often is needed. Most schools hire counselors to give individual attention to students' educational, career, and social development.

A counselor role is to help students understand themselves better—their abilities, talents, and career options, for example. To accomplish this, counselors may use tests and individual or group counseling; sometimes they develop specialized methods or seek the assistance of community resource persons.

When helping students in career choices, counselors often administer and evaluate tests. Some counselors also have responsibility for a career information center and the school's career education program. The counselor may, for example, suggest ways in which a math teacher can incorporate into a lesson information on occupations that require mathematics. Or the counselor may arrange field trips to factories and business firms or show films which provide a view of real work settings. The desired result is a student who is more aware of careers that match his or her talents, likes, and abilities and who can, with the assistance of the counselor, develop an educational and career plan.

School counselors must keep up-to-date on opportunities for educational and vocational training beyond high school to counsel students who want this information. They must keep informed about training programs in 2- and 4-year colleges; in trade, technical, and business schools; apprenticeship programs; and available federally supported programs. Counselors also advise students about educational requirements for entry level jobs, job changes caused by technological advances, college entrance requirements, and places of employment.

Counselors in junior high and high schools often help students find part-time jobs, either to enable them to stay in school or to help them prepare for their vocation. They may help both graduates and dropouts to find jobs or may direct them to community employment services. They also may conduct surveys to learn more about hiring experiences of recent graduates and dropouts, local job opportunities, or the effectiveness of the educational and guidance programs.

Counselors also work with problems affecting the school as a whole or one or two individuals. If drug abuse is a problem, counselors may, for example, initiate group counseling sessions to discuss the dangers of taking drugs. Or they may speak individually with students and their parents.

Counselors work closely with other staff members of the school, members of the community, and parents. Often, teachers and counselors confer about problems affecting a student or group of students. A teacher may refer a student who appears to have problems dealing with classmates to a counselor who will attempt to find the cause. Counselors

School counselors must keep up to date on opportunities for education and vocational training.

may arrange meetings with parents or community agencies, such as mental health organizations, if a student's problems are serious.

Elementary school counselors help children to make the best use of their abilities by identifying these and other basic aspects of the child's makeup at an early age, and by evaluating any learning problems. Methods used in counseling grade school children differ in many ways from those used with older students. Observations of classroom and play activity furnish clues about children in the lower grades. To better understand children, elementary school counselors spend much time consulting with teachers and parents. They also work closely with other staff members of the school, including psychologists and social workers.

Some school counselors, particularly in secondary schools, teach classes in occupational information, social studies, or other subjects. They also may supervise school clubs or other extracurricular activities, often after regular school hours.

Places of Employment

About 43,000 people worked full time as public school counselors during 1976. Most counselors work in large schools. An increasing number of school districts, however, provide guidance services to their small schools by assigning more than one school to a counselor.

Training, Other Qualifications, and Advancement

Most States require school counselors to have counseling and teaching certificates. However, a growing number of States no longer require teacher certification. (See statements on elementary and secondary school teachers for certificate requirements.) Depending on the State, a master's degree in counseling and from 1 to 5 years of teaching experience usually are required for a counseling certificate. People who plan to become counselors should learn the requirements of the State in which they plan to work since requirements vary among States and change rapidly.

College students interested in becoming school counselors usually take the regular program of teacher education, with additional courses in psychology and sociology. In States where teaching experience is not a requirement, it is possible to major in a liberal arts program. A few States substitute a counseling internship for teaching experience. In some States teachers who have completed part of the courses required for the master's degree in counseling are eligible for provisional certification and may work as counselors under supervision while they take additional courses.

Counselor education programs at the graduate level are available in more than 450 colleges and universities, usually in the departments of education or psychology. One to 2 years of graduate study are necessary for a master's degree. Most programs provide supervised field experience.

Subject areas of required graduate level courses usually include appraisal of the individual student, individual counseling procedures, group guidance, information service for career development, professional relations and ethics, and statistics and research.

The ability to help young people accept responsibility for their own lives is important for school counselors. They must be able to coordinate the activity of others and work as part of the team which forms the educational system.

School counselors may advance by moving to a larger school; becoming director or supervisor of counseling or guidance; or, with further graduate education, becoming a college counselor, educational psychologist, school psychologist, or school administrator. Usually college counselors and educational psychologists must earn the Ph. D. degree.

Employment Outlook

Employment of school counselors is likely to grow more slowly than the average for all occupations through the mid-1980's as declining school enrollments coupled with financial constraints limit demand. If Federal assistance for career education is increased, however, many more jobs should result. Thus, future growth in counselor employment will depend

largely on the amount of funds that the Federal Government provides to the States.

Earnings and Working Conditions

According to a recent survey, the average salary of school counselors ranged from $11,646 to $18,929. School counselors generally earn more than teachers at the same school. (See statements on kindergarten and elementary school teachers and secondary school teachers.)

In most school systems, counselors receive regular salary increments as they obtain additional education and experience. Some counselors supplement their income by part-time consulting or other work with private or public counseling centers, government agencies, or private industry.

Sources of Additional Information

State departments of education can supply information on colleges and universities that offer training in guidance and counseling as well as on the State certification requirements.

Additional information on this field of work is available from:

American School Counselor Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

EMPLOYMENT COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Uncertainty about career plans is a problem faced not only by youngsters in school but also by many adults. Many persons lack realistic career goals, adequate job training, or knowledge about the labor market. Some become unemployed. Veterans and school dropouts are examples of other individuals who often do not know how to turn their talents and abilities into marketable skills. Employment counselors (sometimes called vocational counselors) help these and other jobseekers.

Most employment counselors assist persons who turn to State or community agencies for advice. The handicapped, older workers, and individuals displaced by automation and industry shifts or unhappy with their present occupational fields are typical applicants. Some jobseekers are skilled in specific occupations and ready for immediate job placement; others, who have little education and lack marketable skills, need intensive training to prepare for jobs. In State employment services, the counselor also helps those who are least employable, such as welfare recipients, ex-prisoners, and the educationally and culturally deprived.

Counselors interview jobseekers to learn employment-related facts about their interests, training, work experience, work attitudes, physical capacities, and personal traits. If necessary, they may get additional data by arranging for aptitude and achievement tests and interest inventories, so that more objective advice may be given. They also may get additional information by speaking with the applicant's former employer or school principal.

When a jobseeker's background—the person's abilities and limitations has been thoroughly reviewed, the employment counselor discusses occupational requirements and job opportunities in different fields within the potential of the jobseeker. Then the counselor and the client develop a vocational plan. This plan may specify a series of steps involving remedial education, job training, work experience, or other services needed to enhance the person's employability.

In many cases, employment counselors refer jobseekers to other agencies for physical rehabilitation or psychological or other services before or during counseling. If, for example, a person is hampered in a job search because of stuttering, the counselor might suggest visits with city or county medical personnel. Proper referrel requires that counselors be familiar with the available community services so that they can select those most likely to benefit a particular jobseeker.

Counselors may help jobseekers by suggesting employment sources and appropriate ways of applying for work. In some cases, counselors may contact employers about jobs for applicants, although in State employment services agencies, placement specialists often handle this work. After job placement or entrance into training, counselors may follow up to determine if additional assistance is needed.

The expanding responsibility of public employment service counselors for improving the employability of disadvantaged persons has increased their contacts with these persons during training and on the job. Also, it has led to group counseling and the stationing of counselors in neighborhood and community centers.

Places of Employment

In 1976, about 3,400 persons worked as employment counselors in State employment service offices, located in every large city and many smaller towns. In addition, about 3,000 employment counselors worked for various private or community agencies, primarily in the larger cities. Some worked in institutions such as prisons, training schools for delinquent youths, and mental hospitals. Also, the Federal Government employed a limited number of employment counselors, chiefly in the Veterans Administration and in the Bureau of Indian Affairs. Some counselors teach in graduate training programs or conduct research.

Training, Other Qualifications, and Advancement

The national qualification standard for first level employment counselors in State employment service offices calls for 30 graduate semester hours of counseling courses beyond a bachelor's degree. However, 1 year of counseling-related experience may be substituted for 15 graduate semester hours.

All States require counselors in their public employment offices to meet State civil service or merit system requirements that include minimum educational and experience standards.

Applicants with advanced degrees and additional qualifying experience may enter at higher levels on the counselor career ladder. Many States

also make provision for individuals with extensive experience in the employment service, whether or not they have college degrees, to enter the counselor career ladder and move upward by acquiring the prescribed university coursework and qualifying experience for each level.

Although minimum entrance requirements are not standardized among private and community agencies, most prefer, and some require, a master's degree in vocational counseling or in a related field such as psychology, personnel administration, counseling, guidance education, or public administration. Many private agencies prefer to have at least one staff member who has a doctorate in counseling psychology or a related field. For those lacking an advanced degree, employers usually emphasize experience in closely related work such as rehabilitation counseling, employment interviewing, school or college counseling, teaching, social work, or psychology.

In each State, the public employment service offices provide some in-service training programs for their new counselors or trainees. In addition, both their new and experienced counselors often are given part-time training at colleges and universities during the regular academic year or at institutes or summer sessions. Private and community agencies also often provide in-service training opportunities.

College students who wish to become employment counselors should enroll in courses in psychology and basic sociology. At the graduate level, requirements for this field usually include courses in techniques of counseling, psychological principles and psychology of careers, assessment and appraisal, cultures and environment, and occupational information. Counselor education programs at the graduate level are available in more than 450 colleges and universities, mainly in departments of education or psychology. To obtain a master's degree, students must complete 1 to 2 years of graduate study including actual experience in counseling under the supervision of an instructor.

Persons aspiring to be employment counselors should have a strong interest in helping others make vocational plans and carry them out. They should be able to work independently and to keep detailed records.

Well-qualified counselors with experience may advance to supervisory or administrative positions in their own or other organizations. Some may become directors of agencies or of other counseling services, or area supervisors of guidance programs; some may become consultants; and others may become professors in the counseling field.

Employment Outlook

Employment counselors with master's degrees or experience in related fields are expected to face some competition in both public and community employment agencies through the mid-1980's. Actual growth in employment of counselors will depend in large part on the level of Federal funding to State, local and community agencies to provide counseling services. Some openings for employment counselors will result, however, from the need to replace those who die, retire, or transfer to other occupations.

Earnings and Working Conditions

Salaries of employment counselors in State employment services vary considerably from State to State. In 1976, salaries ranged from about $7,000 for entry level positions to $21,000 for experienced counselors. The average starting salary for beginning workers was $10,506, while experienced counselors averaged $13,814.

According to the limited data available, the average starting salary for counselors in private, nonprofit organizations in 1976 was $8,500. The average for experienced workers was $16,000. In general, salaries of employment counselors are about 1 1/2 times as high as average earnings for all nonsupervisory workers in private industry, except farming.

Most counselors work about 40 hours a week and have various benefits, including vacations, sick leave, pension plans, and insurance coverage. Counselors employed in community agencies may work overtime.

Sources of Additional Information

For general information on employment or vocational counseling, contact:

National Employment Counselors Association, 1607 New Hampshire Ave., NW., Washington, D.C. 20009.

National Vocational Guidance Association, 1607 New Hampshire Ave. NW., Washington D.C. 20009.

U.S. Department of Labor, Employment and Training Administration, USES, Division of Counseling and Testing, Washington, D.C. 20210.

The administrative office for each State's employment security agency, bureau, division, or commission can supply specific information about local job opportunities, salaries, and entrance requirements for positions in public employment service offices.

REHABILITATION COUNSELORS

(D.O.T. 045.108)

Nature of the Work

Each year more mentally, physically, and emotionally disabled persons become self-sufficient and productive citizens. They find employment in a wide variety of occupations previously thought too complex or dangerous for them to handle. A growing number are studying in colleges and technical schools throughout the United States. One member of the team of professionals who help uisabled individuals leave a sheltered environment to lead as normal a life as possible is the rehabilitation counselor.

Rehabilitation counselors begin their work by learning about their client. They may read school reports, confer with medical personnel, and talk with family members to determine the exact nature of the disability. They also discuss with physicians, psychologists, and occupational therapists the types of skills the client can learn. At that point, the counselor begins a series of discussions with the client to explore training and career options. The counselor then uses

this information to develop a rehabilitation plan.

A rehabilitation program generally includes specific job training, such as secretarial studies, as well as other specialized training the disabled person may need. When working with a blind individual, for example, the counselor may arrange for training with seeing-eye dogs. The disabled person then may spend a few months learning to cross streets and ride public transportation systems. Throughout this period, the counselor and disabled client meet reguarly to discuss progress in the rehabilitation program and any problems that may arise.

Counselors also must find jobs for disabled persons and often make follow-up checks to insure that placement has been successful. If the new employee has a specific problem on the job, the counselor may suggest adaptations to the employer.

Rehabilitation counselors must maintain close contact with handicapped clients and their families over many months or even years. The counselor often has the satisfaction of watching day-by-day progress in the disabled person's fight for independence. At other times, however, the counselor may experience the disappointment of a client's failures.

Because job placement is an important aspect of a counselor's work, he or she must keep in touch with members of the business community to learn the type of jobs available and training required. They also try to alleviate any fears on the part of employers about the suitability of hiring handicapped individuals. As a result, counselors may spend time publicizing the rehabilitation program to business and community associations.

An increasing number of counselors specialize in a particular area of rehabilitation; some may work almost exclusively with blind people, alcoholics or drug addicts, the mentally ill, or retarded persons. Others may work almost entirely with persons living in poverty areas.

The amount of time spent counseling each client varies with the severity of the disabled person's problems as well as with the size of the counselor's caseload. Usually, counselors in private organizations can spend more time with clients than their counterparts in State agencies. Some rehabilitation counselors are responsible for many persons in various stages of rehabilitation; on the other hand, less experienced counselors or those working with the severely disabled may work with relatively few cases at a time.

Rehabilitation counselor assisting blind person in use of tape recorder.

Places of Employment

About 19,000 persons worked as rehabilitation counselors in 1976. About 70 percent worked in State and local rehabilitation agencies financed cooperatively with Federal and State funds. Some rehabilitation counselors and counseling psychologists worked for the Veterans Administration. Rehabilitation centers, sheltered workshops, hospitals, labor unions, insurance companies, special schools, and other public and private agenices with rehabilitation programs and job placement services for the disabled employ the rest.

Training, Other Qualifications, and Advancement

A bachelor's degree with courses in counseling, psychology, and related fields is the minimum educational requirement for rehabilitation counselors. However, employers are placing increasing emphasis on the master's degree in rehabilitation counseling or vocational counseling, or in related subjects such as psychology, education, and social work. Work experience in fields such as vocational counseling and placement, psychology, education, and social work is an asset for securing employment as a rehabilitation counselor. Most agencies have work-study programs whereby employed counselors can earn graduate degrees in the field.

More than 75 college and universities offered graduate programs in rehabilitation counseling in 1976. Usu-

ally, 1 1/2 to 2 years of study are required for the master's degree. Included is a period of actual work experience as a rehabilitation counselor under the close supervision of an instructor. Besides a basic foundation in psychology, courses generally included in master's degree programs are counseling theory and techniques, occupational and educational information, and community resources. Other requirements may include courses in placement and followup, tests and measurements, psychosocial effects of disability, and medical and legislative aspects of rehabilitation.

To earn the doctorate in rehabilitation counseling or in counseling psychology may take a total of 4 to 6 years of graduate study. Intensive training in psychology and other social sciences, as well as in research methods, is required.

Many States require that rehabilitation counselors be hired in accordance with State civil service and merit system rules. In most cases, these regulations require applicants to pass a competitive written test, sometimes supplemented by an interview and evaluation by a board of examiners. In addition, some private organizations require rehabilitation counselors to be certified. To become certified, counselors must pass exams administered by the Commission on Rehabilitation Counselor Certification.

Because rehabilitation counselors deal with the welfare of individuals, the ability to accept responsibility is important. It also is essential that they be able to work independently and be able to motivate and guide the activity of others. Counselors who work with the severely disabled need unusual emotional stability. They must be very patient in dealing with clients who often are discouraged, angry, or otherwise difficult to handle.

Counselors who have limited experience usually are assigned the less difficult cases. As they gain experience, their caseloads are increased and they are assigned clients with more complex rehabilitation problems. After obtaining considerable experience and more graduate education, rehabilitation counselors may advance to supervisory positions or top administrative jobs.

Employment Outlook

Because most State and private rehabilitation agencies are funded primarily by the Federal Government, the extent of employment growth will depend largely on the level of government spending. Additional positions, however, are expected to become available in private companies, such as manufacturing and service firms, for rehabilitation counselors to help in equal employment opportunity efforts. In addition to growth needs, many counselors will be required annually to replace those who die, retire, or leave the field for other reasons.

Earnings and Working Conditions

Salaries of beginning rehabilitation counselors in State agencies averaged $10,441 a year in 1976. Beginning salaries ranged from $7,200 in Puerto Rico to $15,774 in Alaska.

The Veterans Administration paid counseling psychologists with a 2-year master's degree and 1 year of subsequent experience—and those with a Ph. D.—starting salaries of $17,056 in 1976. Those with a Ph. D. and a year of experience, and those with a 2-year master's degree and much experience, started at $20,442. Some rehabilitation counselors with a bachelor's degree were hired at starting salaries of $11,523 and $14,097. In general, salaries of rehabilitation counselors are above the average earnings for all nonsupervisory workers in private industry, except farming.

Counselors may spend only part of their time in their offices counseling and performing necessary paperwork. The remainder of their time is spent away from the office, working with prospective employers, training agencies, and the disabled person's family. The ability to drive a car often is necessary for this work.

Rehabilitation counselors generally work a 40-hour week or less, with some overtime work required to attend community and civic meetings in the evening. They usually are covered by sick and annual leave benefits and pension and health plans.

Sources of Additional Information

For information about rehabilitation counseling as a career, contact:

American Psychological Association, Inc., 1200 17th St. NW., Washington, D.C. 20036.

American Rehabilitation Counseling Association, 1607 New Hampshire Ave. NW., Washington, D.C. 20009.

National Rehabilitation Counseling Association, 1522 K St. NW., Washington, D.C. 20005.

Information on certification requirements and procedures is available from:

Commission on Rehabilitation Counselor Certification, 520 North Michigan Ave., Chicago, Ill. 60611.

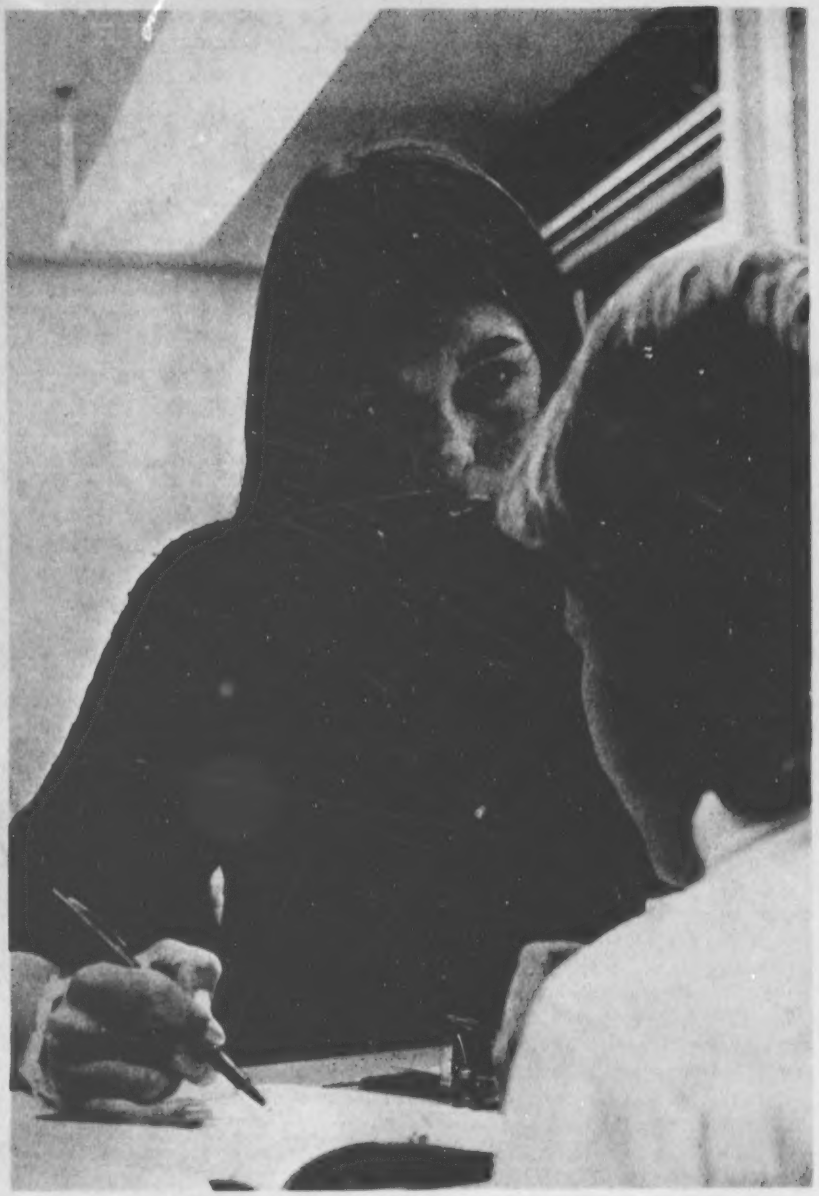
COLLEGE CAREER PLANNING AND PLACEMENT COUNSELORS

(D.O.T. 166.268)

Nature of the Work

Choosing a career is a decision faced by many college students. Finding an occupation that matches one's likes, dislikes, and talents can be difficult and time consuming. And, once the decision is made, there is still the problem of writing resumes, being interviewed, and searching out prospective employers—often an anxiety-producing and discouraging experience.

Career planning and placement counselors help bridge the gap between education and work by assisting students in all phases of career decisionmaking and planning. These counselors, sometimes called college placement officers, provide a variety of services to college students and alumni. They assist students in making career selections by encouraging them to examine their interests, abilities, and goals, and then helping them to explore possible career alternatives. They may, for example, arrange part-time or summer employment with a local government agency for an architectural student considering a career as a city planner. Or they



Counselor discusses career alternatives with college student.

may discuss employment options and training requirements with students majoring in history. Ofen, counselors suggest additional courses or further training to enchance employment prospects.

Career planning and placement counselors also arrange for job recruiters to visit the campus to discuss their firm's personnel needs and to interview applicants. They provide employers with information about students and inform students about business operations and personnel needs in industry. A counselor may, for example, explain to students that workers in certain industries are subject to layoffs. In order to counsel students adequately, counselors must keep abreast of job market developments by reading literature in the field and maintaining contact with industry and government personnel recruiters.

Some career planning and placement counselors, especially those in junior or community colleges, advise administrators on curriculum and course content. They may suggest courses that employers believe would train students more adequately. In addition, some counselors, especially those working in small schools, also teach. All counselors maintain a library of career guidance and recruitment information.

Placement counselors may specialize in areas such as law, education, or part-time and summer work. However, the extent of specialization usually depends upon the size and type of college as well as the size of the placement staff.

Places of Employment

Nearly all 4-year colleges and universities and many of the increasing number of junior colleges provide career planning and placement services to their students and alumni. Large colleges may employ several counselors working under a director of career planning and placement activities; in many institutions, however, a combination of placement functions is performed by one director aided by a clerical staff. In some colleges, especially the smaller ones, the functions of career counselors may be performed on a part-time basis by members of the faculty or administrative staff. Universities frequently have placement officers for each major branch or campus.

About 3,900 persons worked as career planning and placement counselors in colleges and universities in 1976. Nearly three-fourths worked in 4-year institutions. The remainer worked in junior and community colleges.

Training, Other Qualifications, and Advancement

Although no specific educational program exists to prepare persons for career planning and placement work, a bachelor's degree, preferably in a behavioral science, such as psychology or sociology, is customary for entry into the field, and a master's degree is increasingly being stressed.

In 1976, 120 colleges and universities offered graduate programs in college student personnel work.

Graduate courses that are helpful for career planning and placement counseling include counseling theory and techniques, vocational testing, theory of group dynamics, and occupational research and employment trends.

Some people enter the career planning and placement field after gaining a broad background of experience in business, industry, government, or educational organizations. An internship in a career planning and placement office also is helpful.

College career planning and placement counselors must have an interest in people. They must be able to communicate with and gain the confidence of students, faculty, and employers in order to develop insight into the employment needs of both employers and students. People in this field should be energetic and able to work under pressure because they must organize and administer a wide variety of activities.

Advancement for career planning and placement professionals usually is through promotion to an assistant or associate position, director of career planning and placement, director of student personnel services, or some other higher level administrative position. However, the extent of such opportunity usually depends upon the type of college or university and the size of the staff.

Employment Outlook

Employment of college career planning and placement counselors is expected to increase through the mid-1980's. Demand will be greatest in junior and community colleges, where, in many cases, there are no career planning and placement programs at present. In addition, the large number of adults entering community colleges who have been out of the labor market or who are seeking a mid-career change will require specialized counseling.

Also contributing to the demand in all postsecondary institutions will be the expected continued expansion in services to students from minority and low-income groups, who require special counseling in choosing careers and assistance in finding part-time jobs. Growth also is expected in services to the handicapped and to adults participating in continuing education.

However, many institutions of higher education faced financial problems in 1976. If this situation persists, colleges and universities may be forced to limit expansion of counseling and placement services, resulting in competition for available positions.

Earnings and Working Conditions

Salaries vary greatly among educational institutions. According to the limited information available, the average salary of college career planning and placement directors was more than $17,000 a year in 1976.

Career planning and placement counselors frequently work more than a 40-hour week; irregular hours and overtime often are necessary, particularly during the "recruiting season." Most counselors are employed on a 12-month basis. They are paid for holidays and vacations and usually receive the same benefits as other professional personnel employed by colleges and universities.

Sources of Additional Information

A booklet on the college student personnel professions, as well as other information on career counseling and placement, is available from:

The College Placement Council, Inc., P.O. Box 2263, Bethlehem, Pa. 18001.

CLERGY

Deciding on a career in the clergy involves considerations different from those involved in other career choices. When persons choose to enter the ministry, priesthood, or rabbinate, they do so primarily because they possess a strong religious faith and a desire to help others. Nevertheless, it is important to know as much as possible about the profession and how to prepare for it, the kind of life it offers, and its needs for personnel.

The number of clergy needed depends largely on the number of people who participate in organized religious groups. This affects the number of churches and synagogues established and pulpits to be filled. In addition to the clergy who serve congregations, many others teach or act as administrators in seminaries and in other educational institutions; still others serve as chaplains in the Armed Forces, industry, correctional institutions, hospitals, or on college campuses; or render service as missionaries or in social welfare agencies.

Persons considering a career in the clergy should seek the counsel of a religious leader of their faith to aid in evaluating their qualifications. The most important of these are a deep religious belief and a desire to serve the spiritual needs of others. The priest, minister, or rabbi also is expected to be a model of moral and ethical conduct. A person considering one of these fields must realize that the civic, social, and recreational activities of a member of the clergy often are influenced and restricted by the customs and attitudes of the community.

The clergy should be sensitive to the needs of others and able to help them deal with these needs. The job demands an ability to speak and write effectively, to organize, and to supervise others. The person entering this field also must enjoy studying because the ministry is an occupation which requires continuous learning. In addition, the ministry demands considerable initiative and self-discipline.

More detailed information on the clergy in the three largest faiths in the United States—Protestant, Roman Catholic, and Jewish—is given in the following statements, prepared in cooperation with leaders of these faiths. Information on the clergy in other faiths may be obtained directly from leaders of the respective groups.

PROTESTANT MINISTERS

(D.O.T. 120.108)

Nature of the Work

Protestant ministers lead their congregations in worship services and administer the rites of baptism, confirmation, and Holy Communion. They prepare and deliver sermons and give religious instruction to persons who are to become new members of the church. They also perform marriages; conduct funerals; counsel individuals who seek guidance; visit the sick, aged, and handicapped at home and in the hospital; comfort the bereaved; and serve church members in other ways. Many Protestant ministers write articles for publication, give speeches, and engage in interfaith, community, civic, educational, and recreational activities sponsored by or related to the interests of the church. Some ministers teach in seminaries, colleges, and universities.

The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination. In many denominations, ministers follow a traditional order of worship; in others they adapt the services to the needs of youth and other groups within the congregation. Most services include Bible reading, hymn singing, prayers, and a sermon. In some denominations, Bible reading by a member of the congregation and individual testimonials may constitute a large part of the service.

Ministers serving small congregations generally work on a personal basis with their parishioners. Those serving large congregations have greater administrative responsibilities, and spend considerable time working with committees, church officers, and staff, besides performing their other duties. They may have one or more associates or assistants who share specific aspects of the ministry, such as a minister of education who assists in educational programs for different age groups, or a minister of music.

Places of Employment

In 1976, about 190,000 ministers served more than 72 million Protes-

The services that ministers conduct differ among Protestant denominations and also among congregations within a denomination.

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tants. Most ministers serve individual congregations. In addition, however, thousands of ministers work in closely related fields such as chaplains in hospitals and the Armed Forces. The greatest number of clergy are affiliated with the five largest groups of churches—Baptist, United Methodist, Lutheran, Presbyterian, and Episcopal.

All cities and most towns in the United States have at least one Protestant church with a full-time minister. Some churches employ part-time ministers; many part-time clergy are seminary students or ministers retired from full-time pastoral responsibilities. Although most ministers are located in urban areas, many live in less densely populated areas where they may serve two congregations or more.

Training and Other Qualifications

Educational requirements for entry into the Protestant ministry vary greatly. Some denominations have no formal educational requirements, and others ordain persons having varying amounts and types of training in Bible colleges, Bible institutes, or liberal arts colleges.

In 1976, there were 138 American theological institutes accredited by the Association of Theological Schools in the United States and Canada. These admit only students who have received a bachelor's degree or its equivalent with a liberal arts major from an accredited college. Many denominations require a 3-year course of professional study in one of these accredited schools or seminaries after college graduation. The degree of master of divinity is awarded upon completion.

Recommended preseminary or undergraduate college courses include English, history, philosophy, the natural sciences, social sciences, the fine arts, music, religion, and foreign languages. These courses provide a knowledge of modern social, cultural, and scientific institutions and problems. However, students considering theological study should contact, at the earliest possible date, the schools to which they intend to apply, to learn how to prepare for the program they expect to enter.

The standard curriculum for accredited theological schools consists of four major categories: biblical, historical, theological, and practical. Courses of a practical nature such as psychology, religious education, and administration are emphasized. Many accredited schools require that students gain experience in church work under the supervision of a faculty member or experienced minister. Some institutions offer doctor of ministry degrees to students who have completed 1 year or more of additional study after serving at least a year as minister. Scholarships and loans are available for students of theological institutions.

In general, each large denomination has its own school or schools of theology that reflect its particular doctrine, interests, and needs. However, many of these schools are open to students from other denominations. Several interdenominational schools associated with universities give both undergraduate and graduate training covering a wide range of theological points of view. Persons who have denominational qualifications for the ministry usually are ordained after graduation from a seminary. In denominations that do not require seminary training, clergy are ordained at various appointed times. Men and women entering the clergy often begin their careers as pastors of small congregations or as assistant pastors in large churches.

Employment Outlook

The trend toward merger and unity among denominations, combined with the closing of smaller parishes and the downturn in financial support, has reduced demand for Protestant ministers in recent years. As a result, new graduates of theological schools will face increasing competition in finding positions. The supply-demand situation will vary among denominations and the chance of obtaining employment will depend, in part, on the length of the candidate's formal preparation. Most of the openings for clergy that are expected through the mid-1980's will therefore result from the need to replace those in existing positions who retire, die, or leave the ministry. The need for ministers in Evangelical churches, however, is expected to continue to grow.

Although fewer opportunities may arise for Protestant ministers to serve individual congregations, newly ordained ministers may find work in youth, family relations, and welfare organizations; religious education; and as chaplains in the Armed Forces, hospitals, universities, and correctional institutions.

Earnings and Working Conditions

Salaries of Protestant clergy vary substantially, depending on age, experience, education, denomination, size and wealth of congregation, type of community, and geographic location. According to a study by the Institute for Church Development, average income including benefits for Protestant ministers in five denominations was about $13,650 in 1976. These earnings are somewhat higher than the average for Protestant denominations as a whole. Annual vacations average 3 weeks and there often is opportunity for time off.

Because of the wide range of service that the minister provides, he or she may work long or irregular hours, often involving considerable travel.

Sources of Additional Information

Persons who are interested in entering the Protestant ministry should seek the counsel of a minister or church guidance worker. Each theological school can supply information on admission requirements. Prospective ministers also should contact the ordination supervision body of their particular denomination for information on special requirements for ordination.

RABBIS

(D.O.T. 120.108)

Nature of the Work

Rabbis are the spiritual leaders of their congregations and teachers and interpreters of Jewish law and tradition. They conduct religious services

and deliver sermons at services on the Sabbath and on Jewish holidays. Rabbis customarily are available at all times to counsel members of their congregation, other followers of Judaism, and the community at large. Like other clergy, rabbis conduct weddings and funeral services, visit the sick, help the poor, comfort the bereaved, supervise religious education programs, engage in interfaith activities, and involve themselves in community affairs.

Rabbis serving large congregations may spend considerable time in administrative duties, working with their staffs and committees. Large congregations frequently have an associate or assistant rabbi. Many assistant rabbis serve as educational directors.

Nearly all rabbis serve Orthodox, Conservative, or Reform congregations. Regardless of their particular point of view, all Jewish congregations preserve the substance of Jewish religious worship. The congregations differ in the extent to which they follow the traditional form of worship—for example, in the wearing of head coverings, the use of Hebrew as the language of prayer, or the use of music or a choir. The format of the worship service and, therefore, the ritual that the rabbis use may vary even among congregations belonging to the same branch of Judaism.

Rabbis also may write for religious and lay publications, and teach in theological seminaries, colleges, and universities.

Places of Employment

About 4,000 rabbis served over 6 million followers of the Jewish faith in this country in 1976; approximately 1,550 were Orthodox rabbis, 1,350 were Conservative, and 1,200 Reform. Others work as chaplains in the military services, in hospitals and other institutions, or in one of the many Jewish community service agencies. A growing number are employed in colleges and universities as teachers in Jewish Studies programs.

Although rabbis serve Jewish communities throughout the Nation, they are concentrated in those States that have large Jewish populations, particularly New York, California, Pennsylvania, New Jersey, Illinois, Massachusetts, Florida, Maryland, and the Washington, D.C. metropolitan area.

Training and Other Qualifications

To become eligible for ordination as a rabbi, a student must complete a prescribed course of study in a seminary. Entrance requirements and the curriculum depend upon the branch of Judaism with which the seminary is associated.

Nearly 30 seminaries train Orthodox rabbis in programs of varying lengths. The required course of study to prepare for ordination is usually 3 or 4 years. However, students who are not college graduates may spend a longer period at these seminaries and complete the requirements for the bachelor's degree while pursuing the rabbinic course. Some Orthodox seminaries do not require a college degree to qualify for ordination, although students who qualify usually have completed 4 years of college.

The Hebrew Union College—Jewish Institute of Religion is the official seminary that trains rabbis for the Reform branch of Judaism. It is the only branch that has approved the training and ordination of women as rabbis. In 1976, almost half the entering class at the Reform seminary were women. The Jewish Theological Seminary of America is the official seminary that trains rabbis for the Conservative branch of Judaism. Both seminaries require the completion of a 4-year college course, as well as earlier preparation in Jewish studies, for admission to the rabbinic program leading to ordination. Normally 5 years of study are required to complete the rabbinic course at the Reform seminary, including 1 year of preparatory study in Jerusalem. Exceptionally well-prepared students can shorten this 5-year period to a minimum of 3 years. A student having a strong background in Jewish studies can complete the course at the Conservative seminary in 4 years; for other enrollees, the course may take as long as 6 years.

In general, the curriculums of Jewish theological seminaries provide students with a comprehensive knowledge of the Bible, Talmud, Rabbinic literature, Jewish history, theology, and courses in education, pastoral psychology, and public speaking. Students of the Reform seminary get a thorough preparation in the classics as well as extensive practical training in dealing with the social and political problems in the community. Training for alternatives

Rabbi instructing nursery school children about the Friday evening Sabbath meal.

to the pulpit, such as leadership in community services and religious education, increasingly is stressed.

Some seminaries grant advanced academic degrees in fields such as Biblical and Talmudic research. All Jewish theological seminaries make scholarships and loans available.

Newly ordained rabbis usually begin as leaders of small congregations, assistants to experienced rabbis, directors of Hillel Foundations on college campuses, teachers in seminaries and other educational institutions, or chaplains in the Armed Forces. As a rule, the pulpits of large and well-established Jewish congregations are filled by experienced rabbis.

Employment Outlook

The demand for Rabbis has declined in recent years because some established congregations have closed and fewer new ones are being formed. As a result, many newly ordained Rabbis will take positions in smaller Jewish communities and as assistant Rabbis in larger Jewish congregations. Opportunities still exist for Rabbis to teach in colleges and universities, to serve as chaplains in the Armed Forces, and to work in hospitals and other institutions or in one of the many Jewish social service agencies. Openings in established congregations will come largely from a need to replace those Rabbis who retire or die.

The employment outlook for rabbis varies among the three major branches of Judaism, however. Reform rabbis may face some competition for available positions and Orthodox clergy are expected to encounter very keen competition. Conservative rabbis, on the other hand, will have good employment opportunities, if present trends continue.

Earnings and Working Conditions

Incomes vary depending on the size and financial status of the congregation, as well as its denominational branch and geographic location. Rabbis usually earn additional income from gifts or fees for officiating at ceremonies such as weddings.

In 1976 the annual earnings of rabbis averaged between $15,000 and $20,000, including pension and housing allowance. Earnings of Orthodox rabbis tended to be at the lower end of the scale. Average earnings of newly ordained Conservative and Reform rabbis were about $19,000; more experienced rabbis earned much higher salaries and, with other benefits, averaged as much as $35,000 a year. Some senior rabbis in large temples earned up to $60,000 a year.

Rabbis' working hours are determined by their role in the congregation. Besides conducting regular religious services, they also may spend considerable time in administrative, educational, and community service functions, as well as presiding over various ceremonial services. Rabbis also must be available to serve the emergency needs of their congregation members.

Sources of Additional Information

Persons who are interested in becoming rabbis should discuss their plans for a vocation with a practicing rabbi. Information on the work of rabbis and allied occupations can be obtained from:

The Jewish Theological Seminary of America, (Conservative), 3080 Broadway, New York, New York 10027.

The Rabbi Issac Elchanan Theological Seminary, an affiliate of Yeshiva University, (Orthodox), 2540 Amsterdam Ave., New York, N.Y. 10033.

Hebrew Union College and Jewish Institute of Religion, (Reform), whose three campuses are located at 40 W. 68th St., New York, N.Y. 10023; at 3101 Clifton Ave., Cincinnati, Ohio 45220; and at 3077 University Mall, Los Angeles, Calif. 90007.

ROMAN CATHOLIC PRIESTS

(D.O.T. 120.108)

Nature of the Work

Roman Catholic priests attend to the spiritual, pastoral, moral, and educational needs of the members of their church. Their duties include presiding at liturgical functions; offering religious enlightenment in the form of a sermon; hearing confessions; administering the Sacraments (including the sacraments of Marriage and Penance); and conducting funeral services. They also comfort the sick, console relatives and friends of the dead, counsel those in need of guidance, and assist the poor.

Priests spend long hours working for the church and the community. Their day usually begins with morning meditation and Mass, and may end with the hearing of confessions or an evening visit to a hospital or a home. Many priests direct and serve on church committees, work in civic and charitable organizations, and assist in community projects.

There are two main classifications of priests—diocesan (secular) and religious. Both types have the same powers acquired through ordination by a bishop. The differences lie in their way of life, the type of work to which they are assigned, and the church authority to whom they are immediately subject. Diocesan priests generally work as individuals in parishes assigned to them by the bishop of their diocese. Religious priests generally work as part of a religious order, such as the Jesuits, Dominicans, or Franciscans. They engage in specialized activities such as teaching or missionary work assigned to them by superiors of their order.

Both religious and diocesan priests

The number of priests has been insufficient to fill all the needs of Catholic institutions.

hold teaching and administrative posts in Catholic seminaries, colleges and universities, and high schools. Priests attached to religious orders staff a large proportion of the institutions of higher education and many high schools, whereas diocesan priests are usually concerned with the parochial schools attached to parish churches and with diocesan high schools. The members of religious orders do most of the missionary work conducted by the Catholic Church in this country and abroad.

Places of Employment

Approximately 59,000 priests served nearly 49 million Catholics in the United States in 1976. There are priests in nearly every city and town and in many rural communities. The majority are in metropolitan areas, where most Catholics reside. Catholics are concentrated in the Northeast and Great Lakes regions, with smaller concentrations in California, Texas, and Louisiana. Large numbers of priests are located in communities near Catholic educational and other institutions.

Training and Other Qualifications

Preparation for the priesthood generally requires 8 years of study beyond high school. There are over 450 seminary institutions where students may receive training for the priesthood. Preparatory study may begin in the first year of high school, at the college level, or in theological seminaries after college graduation.

High school seminaries provide a college preparatory program that emphasizes English grammar, speech, literature, and social studies. Some study of Latin is required and the study of modern language is encouraged. The seminary college offers a liberal arts program, stressing philosophy and religion; the study of man through the behavioral sciences and history; and the natural sciences and mathematics. In many college seminaries, a student may concentrate in any of these fields.

The remaining 4 years of preparation include sacred scripture; dogmatic, moral, and pastoral theology; homiletics (art of preaching); church history; liturgy (Mass); and canon law. Field work experience usually is required in addition to classroom study; in recent years this aspect of a priest's training has been emphasized. Diocesan and religious priests attend different major seminaries, where slight variations in the training reflect the differences in the type of work expected of them as priests. Priests are not permitted to marry.

Postgraduate work in theology is offered at a number of American Catholic universities or at ecclesiastical universities around the world, particularly in Rome. Also, many priests do graduate work at other universities in fields unrelated to theology. Priests are encouraged by the Catholic Church to continue their studies, at least informally, after ordination. In recent years continuing education for ordained priests has stressed social sciences, such as sociology and psychology.

Young men never are denied entry into seminaries because of lack of funds. In seminaries for secular priests, the church authorities may make arrangements for student scholarships or loans. Those in religious seminaries are financed by contributions of benefactors.

The first assignment of a newly ordained secular priest is usually that of assistant pastor or curate. Newly ordained priests of religious orders are assigned to the specialized duties for which they are trained. Depending on the talents, interests, and experience of the individual, many opportunities for greater responsibility exist within the church.

Employment Outlook

A growing number of priests will be needed in the years ahead to provide for the spiritual, educational, and social needs of the increasing number of Catholics in the Nation. The number of ordained priests has been insufficient to fill the needs of newly established parishes and other Catholic institutions, and to replace priests who retire or die. This situation is likely to persist and perhaps worsen, if the recent drop in seminary enrollments continues. However, permanent deacons, who may marry and hold full-time jobs outside the Church, are being ordained as Catholic ministers to preach and perform other liturgical functions, such as communion and baptism. They are not permitted to celebrate Mass or hear confession. Although priests usually continue to work longer than persons in other professions, the varied demands and long hours create a need for young priests to assist the older ones. Also, an increasing number of priests have been acting in many diverse areas of service—in social work; religious radio, newspaper, and television work; and labor-management mediation. They also have been serving in foreign posts as missionaries, particularly in countries that have a shortage of priests.

Earnings and Working Conditions

Diocesan priests' salaries vary from diocese to diocese and range from $2,000 to $6,000 a year. The diocesan priest also may receive a car allowance of $25 to $50 a month, free room and board in the parish rectory, and fringe benefits such as group insurance and retirement benefits in the diocese.

Religious priests take a vow of poverty and are supported by their religious order.

Priests who do special work related to the church, such as teaching, usually receive a partial salary which is less than a lay person in the same position would receive. The difference between the usual salary for these jobs and the salary that the priest receives is called "contributed service." In some of these situations, housing and related expenses may be provided; in other cases, the priest must make his own arrangements. Some priests doing special work may receive the same compensation that a lay person would receive. These may include priests working as lawyers, counselors, consultants, etc.

Due to the wide range of duties which most clergy have, priests often must work long and irregular hours. Their working conditions vary widely with the type and area of assignment.

Sources of Additional Information

Young men interested in entering

the priesthood should seek the guidance and counsel of their parish priest. For information regarding the different religious orders and the secular priesthood, as well as a list of the seminaries which prepare students for the priesthood, contact the diocesan Directors of Vocations through the office of the local pastor or bishop.

OTHER SOCIAL SERVICE OCCUPATIONS

COOPERATIVE EXTENSION SERVICE WORKERS

(D.O.T. 096.128)

Nature of the Work

Cooperative extension service workers, or extension agents as they are often called, conduct educational programs for rural residents in areas such as agriculture, home economics, youth activities, and community resource development. Extension agents generally specialize in one of these areas and have titles that match their specialties, such as extension agent for youth activities or extension agent for agriculture science and horticulture. They are employed jointly by State land-grant universities and the U.S. Department of Agriculture.

Extension agents usually work with groups of people. For example, the extension agent for youth activities conducts 4-H meetings for members in the area. During the summer, they may hold day camps to organize youth recreational activities. Agents who work in home economics set up meetings and programs to illustrate the benefits of proper nutrition and to educate homemakers in good nutrition.

Agriculture science extension agents conduct group meetings on topics of special interest to area farmers. In a county which has much dairy farming, extension agents arrange seminars covering dairy herd health or the raising of forage crops. During these seminars, agents instruct farmers in using the proper feeds to meet cows' nutritional needs and to raise their output of milk, and recognizing and combating health hazards including the possible establishment of a herd inspection program. They also may help local farmers market their products.

Extension agents for community resource development meet with community leaders to plan and provide for economic development of the community. They also assist community leaders in developing recreational programs and facilities and in planning other public projects, such as water supply and sewage systems, libraries and schools.

In addition to group work, they also do field work with individuals. If a farmer is having a problem with his or her crops, an extension agent will visit the farm, examine the problem and suggest remedies. Likewise, home economics extension agents occasionally visit homemakers to give personal help in solving problems.

An important part of each extension worker's job is to provide information that is important to people in the community. Many extension

County extension worker gives technical advice to dairy farmer.

agents write articles dealing with their areas of specialization for publication in local newspapers. Often these are regular feature columns that appear once a week. Others appear on local radio and television shows to give marketing reports for agricultural products important to the area, or present Saturday morning programs for young people. A few extension service workers produce documentary films on topics in which they have special training for broadcast on local television stations. Also, extension workers at some land grant universities produce and broadcast programs on university-owned UHF and cable television stations.

In addition to the extension service workers who work at the county level, State extension specialists, at land grant universities coordinate the efforts of county agents. State extension agents keep abreast of the latest research in their fields of study and develop ways of using the research in extension work at the county level. Some State extension workers may be on a split assignment and may teach classes at the university. Also, about 200 agricultural extension specialists are employed by the Extension Service of the U.S. Department of Agriculture in Washington, D.C.

Places of Employment

More than four-fifths of the approximately 16,000 cooperative extension service workers are employed by counties throughout the United States. Almost all of the more than 3,000 counties have county staffs. Depending on the population of the county, staffs range in size from one agent, who serves a wide variety of clientele interests, to a dozen or more agents, each serving a highly specialized need. Most of the remaining extension agents are employed by State extension services located on the campuses of land grant universities. A few work for regional staffs serving multicounty areas, and a small number are employed by the Extension Service of the U.S. Department of Agriculture. In addition, a few work in urban areas, mostly organizing 4-H activities for youth.

Training, Other Qualifications, and Advancement

Cooperative Extension Service agents are required to be proficient in disciplines related to the needs of their clientele. They must have a bachelor's degree in their subject-matter field. In addition, training in educational techniques and in a communications field such as journalism is extremely helpful.

Often, they receive specific instruction in extension work in a preinduction training program, and can improve their skills through regular in-service training programs that cover both educational techniques and the subject matter for which they are responsible. Beside being proficient in their subject matter extension workers must like to work with people and to help them.

In most States, specialists and agents assigned to multicounty and State staff jobs are required to have at least one advanced degree and in many they must have a Ph. D.

Employment Outlook

The employment of cooperative extension service workers is expected to increase more slowly than the average for all occupation through the mid-1980's. As agricultural technology becomes more complicated, more extension workers trained in education and communications will be needed to disseminate information concerning advances in agricultural research and technology to the farm population. Also, modern farmers often are college educated and, thus, more likely to use innovative farming practices. This may increase the demand for extension agents since extension agents relay advances in farming practices from researchers to farmers.

Earnings and Working Conditions

The salaries of extension workers vary by locality, but, for the most part, they are competitive with salaries of other municipal and county professional employees, such as school teachers.

Extension agents work in offices and in the field. Since most extension service offices are located in small towns, persons who wish to live outside the city may find extension work the ideal career. Extension agents often get great satisfaction out of helping others.

Sources of Additional Information

Additional information is available from County Extension offices, the State Director of the Cooperative Extension Service located at each land-grant university, or the Extension Service, U.S. Department of Agriculture, Washington, D.C. 20250.

HOME ECONOMISTS

(D.O.T. 096.128)

Nature of the Work

Home economists work to improve products, services, and practices that affect the comfort and well-being of the family. Some specialize in specific areas, such as consumer economics, housing, home management, home furnishings and equipment, food and nutrition, clothing and textiles, and child development and family relations. Others have a broad knowledge of the whole professional field.

Most home economists teach. Those in high schools teach students about foods and nutrition; clothing selection, construction and care; child development; consumer education; housing and home furnishings; family relations; and other subjects related to family living and homemaking. They also perform the regular duties of other high school teachers that are described in the statement on secondary school teachers elsewhere in the *Handbook*.

Teachers in adult education programs help men and women to increase their understanding of family relations and to improve their homemaking skills. They also conduct training programs on secondary, postsecondary, and adult levels for jobs related to home economics. Special emphasis is given to teaching those who are disadvantaged and handicapped. College teachers may combine teaching and research and

often specialize in a particular area of home economics.

Home economists employed by private business firms and trade associations promote the development, use, and care of specific home products. They may do research, test products, and prepare advertisements and instructional materials. They also may prepare and present programs for radio and television; serve as consultants; give lectures and demonstrations before the public; and conduct classes for sales persons and appliance service workers. Some home economists study consumer needs and help manufacturers translate these needs into useful products.

Some home economists conduct research for the Federal Government, State agricultural experiment stations, colleges, universities, and private organizations. The U.S. Department of Agriculture employs the largest group of researchers to do work such as study the buying and spending habits of families in all socioeconomic groups and develop budget guides.

Home economists who work for the Cooperative Extension Service conduct adult education programs and 4-H Club and other youth programs in areas such as home management, consumer education, family relations, and nutrition. Extension Service home economists also train and supervise volunteer leaders and paid aides who teach adults and youth. (See statement on Cooperative Extension Service workers elsewhere in the *Handbook*.)

Federal, State, and local governments and private agencies employ home economists in social welfare programs to advise and counsel clients on the practical knowledge and skills needed for effective everyday family living. They also may help handicapped homemakers and their families adjust to physical as well as social and emotional limitations by changing the arrangements in the home; finding efficient ways to manage activities of daily living; aiding in the design, selection, and arrangement of equipment; and creating other methods and devices to enable disabled people to function at their highest possible level. Other home economists in welfare agencies supervise or train workers who provide temporary or part-time help to households disrupted by illness.

Home economists in health services provide special help and guidance in home management, consumer education, and family economics as these relate to family health and well-being. Activities of home economists working in health programs include the following: collaboration and consultation with other professionals on economic and home management needs of patients and their families; direct service to patients through home visits; clinic demonstrations and classes in homemaking skills and child care; counseling in the management of time and resources, including financial aspects; assisting socially and mentally handicapped parents in developing their potential skills for child care and home management; working with agencies and community resources; and supervising homemaker aides.

Places of Employment

About 141,000 people worked in home economics professions in 1976. This figure includes 45,000 dietitians and 5,600 Cooperative Extension Service workers who are discussed in separate statements elsewhere in the *Handbook*.

About 75,000 home economists are teachers, about 50,000 in secondary schools and 7,000 in colleges and universities. More than 15,000 are adult education instructors, some of whom teach part time in secondary schools. Others teach in community colleges, elementary schools, kindergartens, nursery schools, and recreation centers.

More than 5,000 home economists work in private business firms and associations. Several thousand are in research and social welfare programs. A few are self-employed.

Training, Other Qualifications, and Advancement

About 350 colleges and universities offer a bachelor's degree in home economics, which qualifies graduates for most entry positions in the field. A master's or doctor's degree is required for college teaching, for certain research and supervisory positions, for work as an extension specialist, and for most jobs in nutrition.

Home economics majors study sciences and liberal arts—particularly social sciences—as well as special-

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Some home economists work with children.

ized home economics courses. They may concentrate in a particular area of home economics or in what is called general home economics. Advanced courses in chemistry and nutrition are important for work in foods and nutrition; science and statistics for research work; and journalism for advertising, public relations work, and all other work in the communications field. To teach home economics in high school, students must complete the courses required for a teacher's certificate.

Scholarships, fellowships, and assistantships are available for undergraduate and graduate study. Although colleges and universities offer most of these financial grants, government agencies, research foundations, businesses, and the American Home Economics Association Foundation provide additional funds for graduate study.

Home economists must be able to work with people of various incomes and cultural backgrounds and should have a capacity for leadership. Poise and an interest in people also are essential for those who deal with the public. The ability to write and speak well is important. Among the subjects recommended for high school students interested in careers in this field are home economics, speech, English, health, mathematics, chemistry, and the social sciences.

Employment Outlook

Home economists, especially those wishing to teach in high schools, will face keen competition for jobs through the mid-1980's. Other areas of home economics also will experience competitive job market conditions as those unable to find teaching jobs look for other positions. However, for those willing to continue their education toward an advanced degree, employment prospects in college and university teaching are expected to be good.

Although little change is expected in the employment of home economists, many jobs will become available each year to replace those who die, retire, or leave the field for other reasons. The growth that is expected to occur will result from increasing awareness of the contributions that can be made by home economists in child care, nutrition, housing and furnishings design, clothing and textiles, consumer education, and ecology. They also will be needed to promote home products, to act as consultants to consumers, and to do research for improvement of home products and services.

Earnings and Working Conditions

Home economics teachers in public schools generally receive the same salaries as other teachers. In 1976, the average annual salary for public secondary school teachers was $12,395, according to the National Education Association. Teachers with a bachelor's degree in school systems with enrollments of 6,000 or more received starting salaries averaging $8,233 per year in the 1974-75 school year. Beginning teachers with a master's degree started at $9,159 a year. Annual salaries for teachers at the college and university level in 1975-76 ranged from an average minimum of $7,272 for instructors in private 2-year institutions to an average maximum of $25,387 for professors at 4-year public institutions.

The Federal Government paid home economists with bachelor's degrees starting salaries of $9,300 and $11,500 in 1977, depending on their scholastic record. Those with additional education and experience generally earned from $11,500 to $20,400 or more, depending on the type of position and level of responsibility. In 1977, the Federal Government paid experienced home economists average salaries of $20,500 a year.

Cooperative Extension Service workers on the county level averaged $14,000 per year in 1976; those on the State level received substantially higher salaries. In general, home economists earn about 1 1/2 times as much as the average for all nonsupervisory workers in private industry, except farming.

Home economists usually work a 40-hour week. Those in teaching and extension service positions, however, frequently work longer hours because they are expected to be available for evening lectures, demonstrations, and other work. Most home economists receive fringe benefits, such as paid vacation, sick leave, retirement pay, and insurance benefits.

Sources of Additional Information

A list of schools granting degrees in home economics and additional information about home economics careers and graduate scholarships are available from:

American Home Economics Association, 2010 Massachusetts Ave. NW., Washington, D.C. 20036

HOMEMAKER-HOME HEALTH AIDES

Nature of the Work

Homemaker-home health aide is an awkward but descriptive title for this occupation, since the job entails both domestic and social services as well as health care. Employed and supervised by social and health agencies, homemaker-home health aides work in the home to provide whatever assistance is necessary to enable sick persons who cannot perform basic tasks for themselves to remain in their own homes. They provide homemaking services, personal services, instruction, and emotional support for their clients, and they keep records of their clients' progress and activities. Their schedules vary according to their clients' needs. For example, a person who is recuperating from an operation may need daily help for 1 or 2 weeks, while a person who has chronic medical problems may need help for 1 or 2 half-days a week for an indefinite period of time. At times, homemaker-home health aides work with families when the mother is convalescing from an illness and there are small children who need care. Most clients, however, are elderly persons who either live alone or with a spouse who also has medical problems. Usually the clients have no family or friends who can provide the care that is needed.

Homemaking services provided by the aides are manifold. Basic duties include cleaning a client's room, kitchen, and bathroom, doing the

laundry, and changing bed linens. Aides also plan meals (including special diets), shop for food, and prepare meals.

Among the personal services that they perform are assisting with bathing or giving a bed bath, shampooing hair, and helping the client move from bed to a chair or another room. Homemaker-home health aides also check pulse and respiration, help with simple prescribed exercises, and assist with medications. Occasionally, they change dressings, use special equipment such as an hydraulic lift, or assist with braces or artificial limbs.

In addition to these practical duties, homemaker-home health aides offer instruction and psychological support. They often teach clients how to adapt their lives to cope with a new disability or how to prevent further illness. For example, an aide may teach a low-income client how to plan nutritious, low-cost meals. Another client may need instruction on the proper diet for a diabetic. Still another client, newly confined to a wheel chair, may need help in learning how to perform daily tasks. An aide may help a client establish a daily schedule that permits the accomplishment of necessary household duties and provides the exercise necessary for rehabilitation. Providing emotional support and understanding when a client is depressed and lonely is another aspect of the work. This often is more important than the practical jobs since, at times, a sick person's inability to gain strength and independence is more the result of a mental attitude than a physical problem. Lastly, the aide regularly reports changes in the client's condition and helps a professional team decide when the services being given to the client should be changed.

A homemaker home-health aide is assigned specific duties by a supervisor, usually a registered nurse or social worker who works as part of a professional team. The supervisor usually consults the client's physician, especially if the client recently has been discharged from the hospital. Many public or nonprofit agencies require physician certification of need for the service. The supervisor visits the client to decide what services are needed and to discuss the aide's schedule of duties with the client. Often the homemaker-home health aide gives the supervisor a daily report, signed by the client, listing the exact services performed and the hours worked. The supervisor occasionally visits the client to determine if the service is satisfactory.

If the supervisor determines that extensive services will be required over a long period of time, attempts are made to coordinate the assignment of the aide with other in-home services such as meals-on-wheels, friendly visitors, and telephone reassurance. If satisfactory provision for the required care cannot be made, the supervisor will suggest an alternative arrangement such as transfer to a nursing home or a home for the aged. However, unless a client requires 24-hour care, it usually is possible to maintain care in the home through the services provided by homemaker-home health aides—coordinated, where needed, with other community services.

Places of employment

Approximately 70,000 persons were employed as homemaker-home health aides in 1976. Although they work in clients' homes, aides are employed and supervised by social and health agencies that are responsible to the clients for the service provided. These agencies include public health and welfare departments, private health care agencies, and nonprofit community health or welfare organizations such as visiting nurse associations. A few hospitals and nursing homes have extended their services into the community and employ homemaker-home health aides.

Some agencies provide only homemaker-home health aide services while others provide several health or welfare services. In the latter case, the aide is part of a team of professional and paraprofessional workers. For example, in a home health agency, a homemaker-home health aide may be part of a team of nurses, therapists, and other aides who have the same supervisor and who serve all clients in a particular area.

Training, Other Qualifications, and Advancement

Generally, the only educational requirement for employment as a homemaker-home health aide is the ability to read and write; completion of high school usually is not necessary. However, courses in home economics such as meal planning and family living are helpful, especially for younger persons with less personal experience in homemaking. A few agencies require previous training as a nursing aide; some of these agencies also require a year's experience working as a nursing aide in a hospital or nursing home.

Successful homemaker-home health aides are mature persons who like to help people and don't mind hard work. They have a sense of responsibility, compassion, emotional stability, and a cheerful disposition. They are able to overcome an atmosphere of depression and bring brightness into the day of a sick, elderly person. Aides also must be tactful and able to get along with all kinds of people.

In addition to these personal qualities, homemaker-home health aides must have good health since some of their duties, such as lifting, moving, and supporting patients, require above-average physical strength. A physical examination usually is required of applicants.

Homemaker-home health aides usually are middle-aged women. However, younger women, elderly women, and men of all ages also are employed as aides. Although only a small number of men currently are employed in the occupation, additional men are needed, especially to care for those elderly men who prefer a male aide. The minimum age for a homemaker-home health aide is usually 17; however, most agencies prefer people in their 20's at least. Many agencies employ persons who are elderly themselves. Most of these older aides desire part-time employment to supplement their Social Security income. Some agencies employ nursing students who want income from part-time work. College students in appropriate major fields such as home economics or social work occasionally can find summer

work as aides, replacing regular employees who are on vacation.

Shortly after they are hired, homemaker-home health aides undergo orientation and training. The length and quality of this training vary greatly. Agencies that require experience as a nursing aide generally provide only a few hours of orientation. Most agencies, however, provide a 1- or 2-week training program. Topics covered include basic nutrition, meal planning and preparation; personal care of the sick, such as bathing, turning and lifting bed patients; emotional problems accompanying illness; and the aging process and behavior of the elderly.

Supervisors give additional training informally when required for specific case assignments. As aides take on a variety of cases, they develop expertise in caring for persons with many types of illness. Some aides discover a special talent for caring for a specific type of client, such as persons who need help with prescribed exercises, or clients with failing eyesight. In some larger agencies, experienced homemaker-home health aides can specialize in caring for clients with a specific type of problem.

In addition to on-the-job training given by supervisors, many agencies offer seminars from time to time on specific topics such as diets for diabetics, exercises for clients with a heart condition, or coping with depression. As aides gain experience in different types of cases, they can assume more responsibility and become more self-directing, within the scope of their assigned duties. In some agencies, experienced aides can be promoted to special assistant to the supervisor, relieving the supervisor of some of the more routine aspects of supervision and case management.

Persons who are interested in and well suited for work with the elderly should have no trouble finding a job.

Employment Outlook

Employment of homemaker-home health aides is expected to grow much faster than the average for all occupations through the mid-1980's. This very rapid growth of the occupation will occur as a result of growing public awareness of the availability of home care services, and probable changes in Federal legislation to encourage more widespread use of these services.

Over the next 10 years, employment growth in this field will be affected by heightened awareness on the part of the public and the medical profession of the availability of home care services. Support is growing for services that enable people to remain in their own homes as long as possible. Since home care is a relatively new approach to long-term care, many elderly persons and their doctors are not yet aware that it is possible to receive personal care without moving into a nursing home or a home for the aged. However, publicity surrounding investigations into the nursing home industry has raised much interest in alternatives to institutional care for those who do not require constant nursing or personal care. The general awareness of homemaker-home health aide service, then, can be expected to grow in the future.

An equally important factor in determining how the occupation will grow is how much money is available to pay for the service. Federal legislation authorizing greater use of public funds for homemaker-home health services probably will be enacted in the future. Such legislation might

take the form of changes in the Social Security Act to expand Medicare coverage for home health care; adoption of a national health insurance program providing for long-term care; or other measures that would expand health and social services to people in their own homes. Public funds for home care already are available under Title XX of the Social Security Act. Since 1975, when this title took effect, nearly all the States have given high priority to homemaker-home health services in allocating the social service funds alloted them. The trend toward public financing of home care services is expected to continue.

Such trends indicate that the number of jobs for homemaker-home health aides is likely to grow very rapidly through the 1980's. A large number of jobs also will become available because of the need to replace persons who leave the occupation to take other jobs, devote more time to family responsibilities, or retire. Some job openings will arise from the need to replace aides who die. Although there is an abundant supply of persons for work of this type, with its minimal education and experience requirements, the personal qualifications required for the job greatly limit the number of applicants who are hired. Persons who are interested in this work and well suited for it should have no trouble finding and keeping jobs.

Earnings and Working Conditions

Earnings for homemaker-home health aides vary considerably. Beginning wages ranged from about $0.10 to $1.50 an hour higher than the minimum wage, or from $2.10 to $3.60 an hour in 1975. Agencies in large cities that have a high cost of living generally pay higher wages. Agencies that have union contracts usually pay higher wages and offer more benefits. While some agencies pay the same rate to all aides, most agencies give pay increases as aides gain experience and are given more responsibility. A few agencies have career ladders, with the increasing responsibilities and wages of each step stated in detail. Limited data indicate that pay for experienced aides averaged about $3.25 an hour in 1975 with some agencies paying over $4 an hour.

Benefits vary even more than wages. Some agencies offer no benefits at all, while others offer a full package of holidays, vacation, sick leave, health and life insurance, and retirement plans. While some agencies hire only "on call" hourly workers, with no benefits, many agencies also employ aides on a full-time or part-time basis with many benefits and a minimum number of hours guaranteed. A typical full-time aide is guaranteed 36 hours of work a week; earns between $2.25 and $3.25 an hour, depending on length of employment and level of responsibility; has 1 to 3 weeks of paid vacation each year, based on number of years of employment; earns 1 day of sick leave a month; is paid for major holidays; and can participate in health insurance and pension plans. A typical part-time employee works a regular schedule and is guaranteed 20 hours of work a week, receives the same hourly wage as full-time employees, and has similar benefits, allocated according to the number of hours worked. A few agencies also allocate vacation and sick leave to those employees who do not have a guaranteed minimum number of hours or a regular schedule.

Even though agencies carefully screen applicants before they hire a new employee, many homemaker-home health aides leave the occupation during the first few months of employment. The most frequent reasons for leaving center on the nature of the work. Often new employees like the personal care element of the work, but do not like the housekeeping chores. Other new employees dislike the demanding work schedule. The inability of new employees to cope with the physical or emotional problems of clients is another frequent reason for leaving. Agencies fire employees who are irresponsible, repeatedly refuse cases, are absent from work, or perform their work unsatisfactorily.

Homemaker-home health aides who stay in their job have many reasons for liking the work. The occupation has status in comparison with many other jobs that do not require a high school education; aides are important members of a health care team since their regular reporting of changes in a client's condition is the basic information used to reassess the services provided. Another attractive aspect of the occupation is the availability of part-time work. Often persons who have full-time, strictly scheduled jobs as nursing aides in hospitals or nursing homes leave these jobs to work as homemaker-home health aides because they need a part-time or flexible work schedule. A third attractive element of the work is the independence and self-direction homemaker-home health aides have in carrying out day-to-day duties. This element increases as aides gain experience and need less detailed supervision.

The personal satisfaction that comes from helping people is just as important as status, independence, and a flexible schedule. Homemaker-home health aides provide essential services for persons who cannot live alone without help. The work they do keeps households functioning as normally as possible, and enables sick persons to remain at home instead of moving to a nursing home. Often homemaker-home health aides see depressed elderly people "come to life" because someone cared enough to brighten their homes and their lives. Persons who do not mind hard work and want to help people with basic human needs may find homemaker-home health aide a very satisfying occupation.

Sources of Additional Information

Information may be obtained by contacting:

National Council of Homemaker-Home Health Aide Services, 67 Irving Place, New York, N.Y. 10003.

PARK, RECREATION, AND LEISURE SERVICE WORKERS

(D.O.T. 079.128, 159.228, 187.118, 195.168, 195.228)

Nature of the Work

Participation in organized recreation is more important today than

ever before as many Americans find the amount of leisure time in their lives increasing. Park, recreation, and leisure service workers plan, organize, and direct individual and group activities that help people enjoy their leisure hours. They work with people of various ages and socioeconomic groups; the easy-to-reach, and those who have tuned out society; the sick and the well; the emotionally and physically handicapped. Employment settings range from the wilderness to rural to suburban and urban, including the inner city. Jobs can be found in municipal, county, special district, State and Federal tax-supported agencies; voluntary youth service organizations; commercial enterprises; and colleges and universities.

The park, recreation, and leisure service field provides career opportunities in two major areas which, despite some overlap, involve distinctive characteristics and training requirements. Activity with and for people is the chief characteristic of *Recreation Program Services*. Examples of recreation program jobs include playground leaders; program specialists in dance, drama, karate, tennis, the arts, and other physical activity; recreation center directors; therapeutic recreation specialists; camp counselors and wilderness leaders; senior citizen program leaders; civilian special services directors in the Armed Forces; and industrial recreation directors. Participants engage in recreational activity as a means of achieving personal satisfaction and other goals. Skilled leadership is required. The other major career area is *Park Management and Natural Resources*, which focuses on activities in natural and constructed areas, facilities, and environments. Job examples include outdoor recreation planners and park managers. These personnel work closely with others including grounds and facilities maintenance personnel; park rangers; landscape architects; foresters; and soil, range and wildlife conservationists. An understanding of the natural environment, physical planning, and maintenance and operation are essential job requirements. (Separate statements on foresters, range managers, landscape architects, soil conservationists, life scientists, and other closely related occupations are found elsewhere in the *Handbook*).

Park, recreation, and leisure service workers in full-time, year-round jobs occupy a variety of positions at different levels of responsibility. *Recreation program leaders* and *park technicians and aides* provide face-to-face leadership, give instruction in crafts, games, and sports, keep records, maintain recreation facilities, assist park rangers, and staff visitor centers.

Specialists include those trained in dance, drama, and the arts, in landscape architecture, horticulture, forestry, biology, and a variety of other fields. These specialists are employed by many park and recreation agencies and often are involved in program development, planning, implementation, and management.

Supervisors plan programs; supervise recreation leaders or park personnel; manage recreation facilities; provide direction in areas of specialization such as arts and crafts, music, drama, dance, and sports; or supervise leadership personnel over an entire region.

Administrators include directors of parks and recreation, superintendents of parks and/or recreation, and various division heads. These individuals have overall responsibility for administration, budget, personnel, programming and/or park management.

A majority of all paid employees in the park, recreation, and leisure service field are part time or seasonal workers.

Educators teach park and recreation courses, supervise field work students, do research, and provide public service expertise.

Places of Employment

About 85,000 persons were primarily employed year round as park, recreation, and leisure service workers in 1976. The majority worked in public, tax-supported agencies including 2,018 municipal park and recreation departments, 1,211 county park and recreation agencies, 345 special districts, and the State park systems. In addition to these public agencies, a number of other employment settings provide year-round jobs for park, recreation, and leisure service workers.

Several thousand persons work for the Federal Government as recreation specialists (sports, art, music, theatre, therapeutic), outdoor recreation planners, park managers and technicians, and recreation assistants and aides. They work primarily for the Forest Service and Soil Conservation Service of the Department of Agriculture; the Corps of Engineers and Armed Forces Recreation of the Department of Defense; the Veterans Administration; and the National Park Service, Bureau of Land Management, Bureau of Outdoor Recreation, and U.S. Fish and Wildlife Service of the Department of Interior.

Peace Corps and Vista employ park and recreation personnel in 68 foreign countries and in the United States to plan and supervise recreational activities for deprived persons.

Boys' and Girls' Clubs provide a variety of recreational, guidance, and instructional activities to help youngsters grow and work together, to discover their needs, understand themselves, and achieve a sense of responsibility.

Senior centers and retirement communities offer older people a range of recreation and leisure activities, and often employ trained staff to supervise and coordinate the assistance provided by volunteers.

Therapeutic recreation is a rapidly growing specialized field which provides services to help an individual recover or adjust to illness, disability, or a specific social problem. Places where recreational therapists work include hospitals, correctional institutions, health and rehabilitation centers, nursing homes, and private schools and camps for the mentally retarded, emotionally disturbed, and physically handicapped. Therapeutic recreation workers, in conjunction with physicians, prescribe activities on a one-to-one basis.

Many jobs for park, recreation, and leisure service workers are found in private and commercial recreation—including amusement parks, sports and entertainment centers, wilderness and survival enterprises, tourist attractions, vacation excursions, resorts and camps, health spas, clubs, apartment complexes, and other settings.

The park, recreation, and leisure service field is characterized by an unusually large number of part-time, seasonal, and volunteer jobs. Volunteers represent perhaps three out of every four individuals performing service in public park and recreation agencies. Some serve on local park and recreation boards and commissions. The vast majority serve as volunteer activity leaders at local playgrounds, or in youth organizations, nursing homes, hospitals, senior centers, and other settings. Many park and recreation professionals have found that volunteer experience, as well as part-time work during school, can lead directly to a full-time job. A majority of all paid employees in the park, recreation, and leisure service field are part-time or seasonal workers. Typical jobs include summer camp counselors and playground leaders, lifeguards, craft specialists, after school and weekend recreation program leaders, park rangers, maintenance personnel, and others. Many of these jobs are filled by teachers and college students.

Training, Other Qualifications, and Advancement

A college degree with a major in parks and recreation is increasingly important for those seeking full-time career positions in the park, recreation, and leisure service field. Generally, an applicant's level of formal education and training determine the type of job he or she can get.

A number of aide, recreation program leader, and park technician positions currently are filled by high school graduates. However, those seeking career potential should obtain a minimum of an associate degree. Some jobs at the recreation leader level require specialized training in a particular field, such as art, music, drama, or athletics.

Positions as specialists normally require a minimum of a baccalaureate degree. However, the degree usually is in the area of specialization, such as forestry or biology, rather than in parks and recreation.

Most supervisors have a baccalaureate degree plus experience. A degree in parks and recreation may improve chances for career advancement.

A baccalaureate degree and experience are considered minimum requirements for administrators. However, increasing numbers are obtaining master's degrees in parks and recreation as well as in related disciplines. Many persons with backgrounds in other disciplines including social work, forestry, and resource management pursue graduate degrees in recreation.

In 1975, over 1,200 educators taught parks and recreation in junior and community colleges and senior colleges and universities. On the junior college level, 90 percent of the faculty had a master's degree or less while on the senior college level, one-half had a master's degree and the other half had a doctorate.

In 1975, about 165 2-year community colleges offered associate degree recreation leadership and park technician programs; 180 4-year colleges and universities offered park and recreation curriculums. In addition, over 80 master's degree programs and about 25 doctoral programs were offered. Programs in therapeutic recreation were offered by about 45 community and junior colleges and 95 4-year colleges and universities. A number of graduate programs were taught.

The National Recreation and Park Association (NRPA) is beginning a process of accrediting park and recreation curriculums. Students in accredited baccalaureate degree programs will devote about one-half of their time to general education

courses in which they may gain knowledge of the natural and social sciences including an understanding of human growth and development and of people as individuals and as social beings; history and appreciation of human cultural, social, intellectual, spiritual, and artistic achievements; and other areas of interest. Another one-fourth of their time will involve exposure to professional park and recreation education including history, theory, and philosophy; community organization; recreation and park services; leadership supervision and administration; understanding of special populations such as the elderly or handicapped; and field work experience. Students may spend the remainder of their time developing competencies in specialized professional areas such as therapeutic recreation (courses in psychology, health, education, and sociology are recommended), park management, outdoor recreation, park and recreation administration, industrial or commercial recreation (courses in business administration are recommended), camp management, and other areas.

Persons planning park, recreation, and leisure service careers must be good at motivating people and sensitive to their needs. Good health and physical stamina are required. Activity planning calls for creativity and resourcefulness. Willingness to accept responsibility and the ability to exercise judgment are important qualities since park and recreation personnel often work alone. To increase their leadership skills and understanding of people, students are advised to obtain related work experience in high school and college. Opportunities for part-time, summer, or after-school employment, or for volunteer work, may be available in local park and recreation departments, youth service agencies, religious or welfare agencies, nursing homes, camps, parks, or nature centers. Such experience may help students decide whether their interests really point to a human service career. Students also should talk to local park and recreation professionals, school guidance counselors, and others.

After a few years of experience, aides or recreation program leaders may become supervisors. However, additional education may be desired. Although promotion to administrative positions may be easier for persons with graduate training, advancement usually is possible through a combination of education and experience.

An effort currently is underway to establish professional status and recognition for the field of parks and recreation (accreditation of curriculums is discussed earlier in the statement). There currently is no licensing requirement for individuals employed in public park and recreation agencies. However, NRPA has developed national standards for professional and technical personnel, including both education and experience requirements. NRPA expects many States to adopt these standards in the coming years. Some therapeutic recreation workers are subject to mandatory requirements that denote competence to practice their profession. Those working in long-term care facilities must be registered by the NRPA, National Therapeutic Recreation Society's Board of Registration, or by the State in which they work.

Employment Outlook

The need for trained park, recreation, and leisure service workers is expected to grow as physical fitness and recreation become increasingly important to millions of Americans; as the number of older people using senior centers and nursing homes increases; as the demand for camp sites, lakes, streams, trails, and picnic areas increases; as correctional institutions recognize the need for such personnel; as the need develops for creative expression in the arts and humanities; and as the citizen's understanding of the use of our leisure and natural resources increases. However, because of financial uncertainty in both the public and private sectors, this need for trained personnel may not necessarily result in actual employment growth. Many openings, nevertheless, will arise annually from deaths, retirements, and other separations from the labor force.

A 1976 National Recreation and Park Association study indicates that competition is keen for many jobs in municipal, county, special district, and State park systems. Contributing to the competitive job situation are recent sizable increases in the number of park and recreation graduates and the austerity budgets adopted by many local governments and municipalities since the early 1970's.

The long-term employment outlook is difficult to assess, largely because of uncertainty about future funding levels for these and other public services. Furthermore, persons with a wide variety of experience and education may seek to become park, recreation, and leisure service workers. However, persons with formal training and experience in parks and recreation are expected to have the best job opportunities in this field; those with graduate degrees should have the best opportunities for supervisory and administrative positions. If the number of park and recreation curriculums continues to grow, master's and Ph. D. degree holders may find favorable teaching opportunities.

Additional job opportunities are expected in therapeutic recreation, private and commercial recreation, and—to a lesser extent—in senior centers and youth organizations. Opportunities for specially trained therapeutic recreation workers are likely to be favorable, in line with the anticipated need for additional staff in many health-related occupations. By contrast, competition for jobs as camp directors is expected to be very keen.

Job experience prior to graduation will greatly help a graduate find a position. Although competition is expected to be keen, many opportunities for part-time and summer employment will be available for recreation program leaders and aides in local government recreation programs. Many of the summer jobs will be for counselors and craft and athletic specialists in camps.

Earnings and Working Conditions

Starting salaries in State and local governments for recreation program leaders with a bachelor's degree averaged about $9,300 in 1976, ac-

cording to a survey by the International Personnel Management Association. There was a wide salary range among employers—in general, salaries were highest in the West and lowest in the South. Average earnings for park and recreation workers are higher than those for nonsupervisory workers in private industry, except farming.

According to NRPA, 2-year associate degree graduates received starting salaries ranging from $6,500 to $9,500 in 1976. Individuals with baccalaureate degrees obtained park and recreation positions with annual salaries that were in the $7,200 to 12,000 range. Persons with graduate degrees generally received higher salaries. All salaries varied widely depending on the size and type of employing agency and geographic area.

Supervisors' salaries ranged from $10,000 to $20,000. Salaries for specialists varied greatly, but generally were equivalent to those of supervisory personnel. The average salary for chief administrators in public park and recreation agencies was about $20,000, and ranged up to $45,000.

The average annual starting salary for recreational therapists (positions requiring a college degree in recreational therapy or a related field) in hospitals and medical centers was about $10,200 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced recreational therapists in these settings averaged $12,200, and some were as high as $17,800.

Starting salaries for recreation and park professionals in the Federal Government in 1977 were $9,303 for applicants with a bachelor's degree; $11,523 for those with a bachelor's degrees plus 1 year of experience; $14,097 for those with a bachelor's plus 2 years' experience or a master's degree; and $17,056 for those with a bachelor's plus 3 years' experience or a Ph. D. Recreation and park assistants, aides, and technicians earn considerably less than these professionals.

The average week for recreation and park personnel is 35-40 hours. Many camp recreation workers live at the camps where they work, and their room and board are included in their salaries. Most public and private recreation agencies provide vacation and other fringe benefits such as sick leave and hospital insurance.

People entering the park, recreation, and leisure service field should expect some night work and irregular hours. In addition, workers often spend much of their time outdoors when the weather permits.

Sources of Additional Information

Information about parks, recreation, and leisure services as a career, employment opportunities in the field, colleges and universities offering park and recreation curricula, accreditation, and registration and certification standards is available from:

National Recreation and Park Association, Division of Professional Services, 1601 North Kent St., Arlington, Va. 22209.

For information on careers in industrial recreation, contact:

National Industrial Recreation Association, 20 North Wacker Dr., Chicago, Ill. 60606.

For information on careers in camping and job referrals, send postpaid return envelope to:

American Camping Association, Bradford Woods, Martinsville, Ind. 46151.

SOCIAL SERVICE AIDES

(D.O.T. 195.208)

Nature of the Work

Social service or human service aides enable social service agencies to help greater numbers of people by providing services that supplement the work of professional social workers and rehabilitation counselors. Social service aides work under the close guidance and supervision of other professional staff.

Social service aides serve as a link between professional social workers or rehabilitation counselors and people who seek help from social agencies. Aides explain the services and facilities of the agency and help new applicants fill out any required forms. Social service aides perform much of the routine paperwork required in welfare programs. They may keep records on clients up to date, maintain a filing system of reports or control system for periodic case reviews, and fill out school enrollment, employment, medical, and compensation forms.

While such duties are an essential part of the job, the most important aspect of the work is being available when needed to offer encouragement and to assist people in the community who need help.

Social service aides work in many different settings, perform a wide range of duties, and have a number of different job titles. Aides called *income maintenance workers* interview applicants to determine whether they or their families are eligible for help. The aide's responsibilites may include visiting the applicant's home, interviewing friends and relatives, and checking documents such as marriage licenses or birth certificates to determine whether he or she meets the requirements for financial assistance or other services.

Aides usually referred to as *casework aides* or *assistants* work directly with clients. They may help clients locate and obtain adequate housing, food stamps, or medical care, help them apply for unemployment or social security benefits, or refer them to job training. Family crises often bring clients to social service agencies, and aides counsel parents about such problems as children in trouble with the police. Casework aides serve as advocates for clients by accompanying them to clinics to ensure that they receive necessary medical care, making appointments for them at legal aid offices, or by helping them through the red tape that surrounds many welfare programs.

Many social service aides spend most of their work day in the office interviewing clients and helping them fill out forms, telephoning other agencies for information and appointments, and keeping records up to date. Some aides, however, spend most of their time out of the office. Their jobs call for assisting clients in their neighborhoods or homes. Aides called *neighborhood* or *outreach workers* personally contact the residents of an area to explain and discuss agency services. They learn the

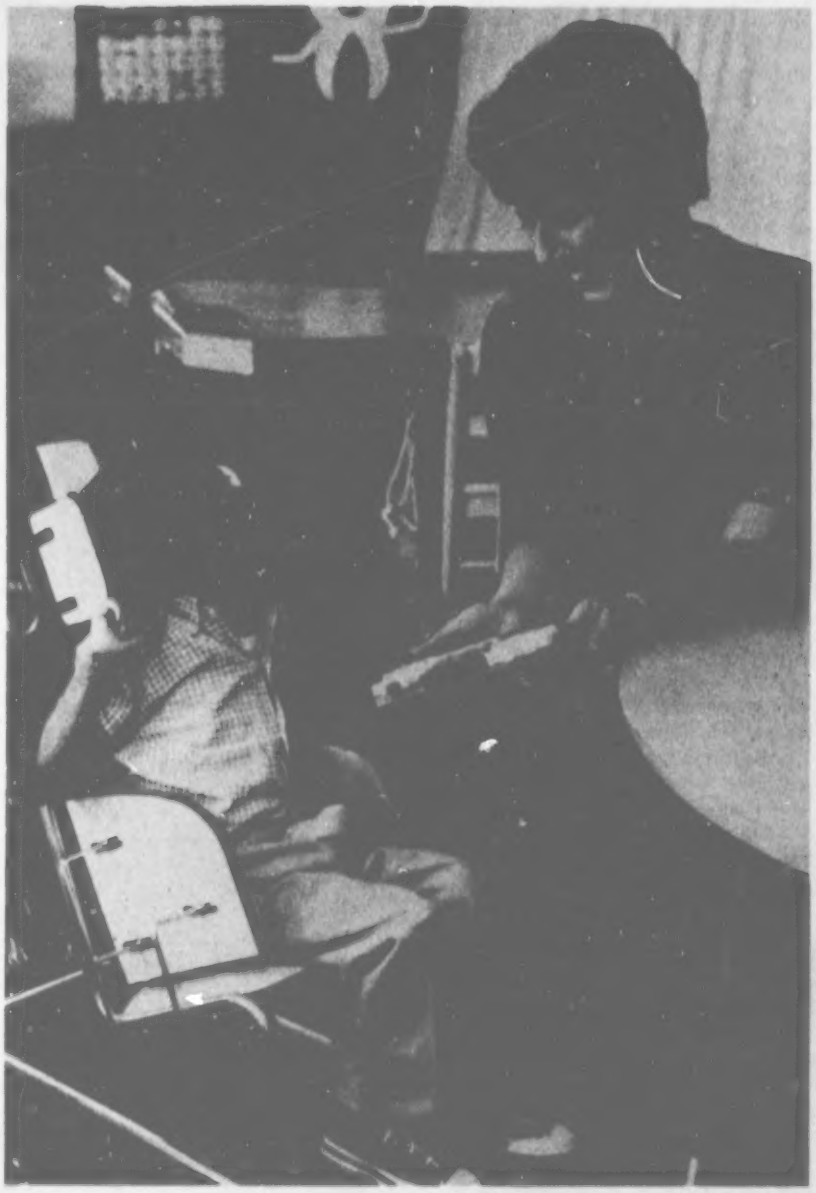
needs of individuals and families and refer routine cases to a counselor or to the appropriate community service agency. They report more difficult problems to a supervisor. Neighborhood workers may inform residents about job openings, available housing, job training opportunities, and public services. On a broader scale, they assist in the organization of block and other neighborhood groups to conduct programs that benefit the neighborhood, foster a sense of community responsibility among residents, and encourage participation in the antipoverty programs of social service agencies. They also may assist in routine neighborhood surveys and counts, keep records, and prepare reports of their activities for the supervisor.

Employment aides also work with clients in the neighborhoods where they live. These aides actively seek out the disadvantaged and help prepare them for employment by giving them assistance in getting special training and counseling. While working in neighborhood centers or mobile units, they locate candidates for available jobs and training programs by contacting unemployed residents in pool rooms, laundromats, and street corners or through employment or welfare agency referrals. They give the unemployed information about the services of the local State employment service office, available job and training opportunities, and help them fill out the necessary application forms. After clients are employed, aides maintain contact to help workers adjust to the new work environment and to iron out minor difficulties.

Homemaker-home health aides work in households where illness, old age, or an emergency makes it difficult for the client to manage everyday tasks. Aides help with such household activities as grocery shopping, cooking, cleaning, mending, child care, and personal care if the client is sick or bedridden. The occupation of homemaker-home health aide is described more fully in a separate statement elsewhere in the *Handbook*.

Places of Employment

About 100,000 people worked as social service aides in 1976. Most work in the inner cities of large metropolitan areas.



Social service aides are a link between professional social workers and the people who seek help.

The overwhelming majority of social service aides work for welfare agencies run by local governments or by voluntary or religious organizations. These include public welfare departments, community and neighborhood centers, family service agencies, halfway houses, and rehabilitation agencies. Most of the remaining aides work in hospitals, clinics, and community health programs, or in schools and public housing projects.

Training, Other Qualifications, and Advancement

Social service aides have a wide range of educational backgrounds, and levels of responsibility often are a function of formal educational attainment. For example, persons with

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a grade school education may enter the field in clerical positions. Those persons with a college degree, on the other hand, may immediately assume more professional responsibilities.

Most social service aide jobs do not require graduation from high school. Many persons enter this field without significant prior work experience. In fact, personal qualities matter most. These include a genuine desire to help people and the ability to communicate with community agencies and clients. In addition to these personal qualities, typing skills and knowledge of an appropriate foreign language for aides working in certain ethnic communities may be helpful.

When hiring, an individual's need for work, potential for upgrading his or her skills, and making a useful contribution to the agency often are chief considerations. As a result, agencies often hire former welfare recipients as social service aides. Some aides are hired as part of government programs to provide subsidized job opportunities for low-income people. For employment in some agencies, an examination or registration on a civil service list may be required.

Most employers emphasize the development of career ladders with opportunities for advancement through a combination of on-the-job training, work experience, and further education. For example, entry level positions as employment aides can lead to a job as an employment interviewer, and, after special training, to employment counselor. Aides usually are trained on the job from 1 to several months. Aides often must acquire knowledge of many social programs including social security, food stamps, and Medicare. They also must receive training from social workers, rehabilitation counselors, nurses and other professionals. Those without high school diplomas often receive classroom instruction to help them pass a high school equivalency examination. Employing agencies frequently pay part of the cost of further education for social service aides.

Aides with college training in this field generally are given the more difficult assignments, sometimes including duties normally performed by social workers. About 140 community and junior colleges offer 2-year programs for social service aides under such diverse titles as "human service aide," "mental health aide," or "social service aide." Training may include course work in sociology and psychology; skills in interviewing, observation and recording of behavior, individual counseling, group dynamics, activity therapy, and behavior modification; and field experience at local helping agencies. Some college graduates with degrees in non-social service areas work as social service aides.

Employment Outlook

Employment of social service aides is expected to grow faster than the average for all occupations through the mid-1980's. Many opportunities are expected for part-time work. A large number of openings will arise from the need to replace aides who die, retire, or leave the occupation for other reasons.

Employment in this field will stem from population growth, coupled with this country's continuing commitment to aid those who are disadvantaged, disabled, or unable to care for themselves. The need to provide social services of many kinds for our aging population is likely to spur an expansion of social welfare programs and create many new jobs for social service aides. Shifts in job duties within welfare agencies also may contribute to the anticipated increase in employment in this occupation. As social welfare services and programs expand, social service aides increasingly will be used for much of the routine work now done by professional personnel.

Earnings and Working Conditions

Full-time social service aides with no prior experience or formal education in the field earned salaries ranging from about $6,000 to $7,500 a year in 1976. Those with experience or additional education usually earned more. The Federal Government paid beginning social service aides salaries ranging from $5,810 to $9,303 in 1977 depending upon their education and prior work experience; experienced aides earned as much as $11,523. Many aides in both public and private agencies work part time and earn less. Average earnings for social service aides are about the same as those for nonsupervisory workers in private industry, except farming.

Although much of their time is spent in offices of social service departments and agencies, aides frequently may visit the homes of clients or offices of other social service agencies, hospitals, and business establishments. They often must work evenings or weekends when clients can be reached.

Sources of Additional Information

Information on requirements for social service aide jobs is available from city, county, or State departments of welfare or social services, community or neighborhood development agencies, and local offices of the State employment service.

SOCIAL WORKERS

(D.O.T. 195.108, .118, .168, and .228)

Nature of the Work

The ability of people to live effectively in society often is hampered by lack of resources and problems that range from personal ones to those arising from social unrest within a group or community. These problems, aggravated by the growing complexity of society, have greatly increased the need for social services. Social workers assist individuals, families, groups and communities in using these services to solve their problems, and work to improve the resources available to enhance social functioning.

The three traditional approaches to social work have been casework, group work, and community organization. The approach chosen usually is determined by the nature of the problem and the time and resources available for solving it. Social workers often combine these approaches in dealing with a specific problem. However, recently developed ways of

organizing curriculums and training social workers have resulted in other approaches to the field. In addition to the traditional methods, social workers may specialize in social institutions which encompasses health, education, and other areas; social problems including poverty; and along other organizing principles and fields of practice.

In casework, social workers use interviews to identify the problems of individuals and families. They then help people to understand and solve their problems and secure the appropriate resources, services, education, or job training. In group work, social workers help people understand themselves and others, overcome racial and cultural prejudices, and work with others in achieving a common goal. They plan and conduct activities for children, teenagers, adults, older persons, and other groups of people in settings such as community centers, hospitals, nursing homes; and correctional institutions. In community organization, social workers coordinate the efforts of groups, such as political, civic, religious, business, and union organizations, to combat social problems through community programs. For a neighborhood or larger area, they may help plan and develop health, housing, welfare, and recreation services. Social workers often coordinate existing social services, organize fund raising for community social welfare activities, and aid in the development of new community services.

The majority of social workers provide social services directly to individuals, families, or groups. However, a substantial number are directors, administrators, or supervisors. Directors of social service agencies have responsibilities much like those of administrators anywhere. They hire and train personnel, make budgetary decisions, develop and evaluate agency problems, solicit new funds, supervise the staff, and serve as a spokesperson for the agency's clients. Some social workers are college teachers, research workers, or consultants. Others work for community agencies and planning bodies at all levels of government, voluntary agencies, and other private organizations.

Social workers apply their training and experience in a variety of settings. While most work for agencies or institutions, growing numbers of social workers are in private practice and provide counseling services on a fee basis.

Social workers in family and child service positions in public and in voluntary agencies such as those run by religious charities, provide counseling and social services that assist individual adjustment, strengthen personal and family relationships, and help clients to cope with their problems. They provide information and referral services in many areas—advising clients on how to plan family budgets and manage money, finding homes for families who have nowhere to go, arranging homemaker assistance for elderly couples who no longer can manage household chores, providing information on job training and day care for parents trying to support a family, and providing help with interpersonal difficulties.

Social workers in child welfare positions work to improve the physical and emotional well-being of deprived and troubled children and youth. They may advise parents on child care and child rearing, counsel children and youth with social adjustment difficulties, and arrange homemaker services during a parent's illness. Social workers may also be called upon to institute legal action for the protection of neglected or mistreated children, provide services to unmarried parents, and counsel couples who wish to adopt a child. After making appropriate case evaluations and home studies, they may place and oversee children in suitable adoption or foster homes or in specialized institutions.

School social workers aid children whose unsatisfactory school progress is related to their social problems. These workers consult and work with parents, teachers, counselors, and other school and community personnel to identify and solve problems that hinder satisfactory adjustment and learning.

Social workers also are employed in medical and psychiatric settings, such as hospitals, clinics, mental health agencies, rehabilitation centers, and public welfare agencies. They aid patients and their families with social problems that may ac-

Some social workers specialize in child welfare.

company illness, recovery, and rehabilitation. As members of medical teams, social workers help patients respond to treatment and guide them in readjusting to their homes, jobs, and communities. Renal social workers (those who deal with patients suffering from kidney disease and their families) and social workers specializing in drug addition perform such functions. (The related occupation of rehabilitation counselor is discussed in a separate statement.)

A growing number of social workers specialize in the field of aging. Many work with elderly persons in public welfare agencies and family service agencies, although workers also are employed in senior centers, helping people deal with financial and role changes brought about by retirement; in area agencies, focusing on planning and evaluating services to the elderly; and in nursing homes, helping patients and their families adjust to illness and the need for institutionalization.

Social workers in correctional institutions and others engaged in correctional programs help offenders and persons on probation and parole readjust to society. They counsel on social problems faced in returning to family and community life, and also may help secure necessary education, training, employment, or community services.

Places of Employment

About 330,000 social workers were employed in 1976. Among these, two-thirds provide direct social services working for public and voluntary agencies, including State departments of public assistance and community welfare and religious organizations. Most of the remainder are involved in social policy and planning, community organization, and administration in government agencies, primarily on the state and local level, while still others work for schools or for hospitals, clinics, and other health facilities. A small but growing number of social workers are employed in business and industry.

Although employment is concentrated in urban areas, many work with rural families. A small number of social workers—employed by the Federal Government and the United Nations or one of its affiliated agencies—serve in other parts of the world as consultants, teachers, or technicians and establish agencies, schools, or assistance programs.

Training, Other Qualifications, and Advancement

Only in the last few years has the bachelor's degree in social work (BSW), rather than the master's degree (MSW), been fully accepted as the minimum education of the professional social worker. The BSW programs generally provide content in the areas of social work practice, social welfare policies and service, human behavior and the social environment, social research, and supervised field experience. Generally, BSW programs prepare people for direct service positions such as case worker or group worker. Quite a few workers in this field have degrees in the liberal arts or humanities, sociology and psychology being the most prevalent majors. However, opportunities for advancement to high-level supervisory and administrative positions tend to be limited for those without graduate training in social work, and are particularly limited for persons with no formal training in this field.

For many positions, a master's degree in social work is preferred or required. Two years of specialized study and supervised field instruction generally are required to earn an MSW. Field placement affords one the opportunity to test his or her suitability for social work practice. The student may develop expertise in a specialized area and make contacts helpful in later securing a permanent position. Previous training in social work is not required for entry into a graduate program, but courses in related fields such as psychology, sociology, economics, political science, history, social anthropology, and urban studies, as well as social work, are recommended. Some graduate schools recently have established accelerated MSW programs for a limited number of highly qualified BSW recipients. However, applicants to graduate programs in social work may face keen competition.

In 1976, over 170 colleges and universities offered accredited undergraduate programs in social work while over 80 offered accredited graduate programs. More than 20 have incorporated a gerontological emphasis into their programs. Graduate students may specialize in clinical social work, community organization, administration, teaching, research, social policy planning, and a variety of other areas. Some schools offer concentrations in many areas while others offer fewer choices.

A limited number of scholarships and fellowships are available for graduate education. Because of increased costs, social welfare agencies have reduced their practice of granting workers "educational leave" to obtain graduate education.

A graduate degree and experience generally are required for supervisory, administrative, or research work, the last also requiring training in social science research methods. Many administrators have a background in social work, business or public administration, education, or health administration. For teaching positions, an MSW is required and a doctorate usually is preferred. In government agencies, most applicants for employment must pass a written exam, with the exception of some high-level positions.

In mid-1976, 20 States had licensing or registration laws regarding social work practice and the use of professional social work titles by those who qualify. Usually work experience, an examination, or both, are necessary for licensing or registration, with periodic renewal required. The National Association of Social Workers allows the use of the title ACSW (Academy of Certified Social Workers) for those members having at least 2 years of postmaster's job experience who have passed the ACSW examination. In view of the emerging trend towards specialization at advanced levels of social work practice, efforts are being made to devise specialized examinations in addition to the general ACSW examination currently given.

Social workers should be emotionally mature, objective, and sensitive, and should possess a basic concern for people and their problems. They

must be able to handle responsibility, work independently, and maintain good working relationships with clients and coworkers.

Students should obtain as much related work experience as possible during high school and college to determine whether they have the interest and capacity for professional social work. They may do volunteer, part-time, or summer work in places such as camps, settlement houses, hospitals, community centers, or social welfare agencies. Some voluntary and public social welfare agencies occasionally hire students for jobs in which they assist social workers.

Employment Outlook

Employment of social workers is expected to increase faster than the average for all occupations through the mid-1980's. The recent passage of Title XX of the Social Security Act, the potential development of national health insurance, and the expansion of services in public education should contribute to a continued increase in employment in social services. Many new positions will come from the expansion of health services in hospitals, nursing homes, community mental health centers, and home health agencies. Other areas expected to offer employment opportunities include services for the aging; counseling in the areas of consumerism, rape, and drug and alcohol abuse; and social planning. Relatively high levels of unemployment coupled with problems caused by social change are expected to sustain a strong demand for persons in the social service field. The increasing need for social workers to assist other professionals in such fields as health planning, transportation, law, and public administration also should stimulate employment growth. In addition to jobs resulting from employment growth, thousands of openings will result annually from deaths and retirements.

If the number of students graduating from social work programs continues to increase at the same rate as in the 1960's and early 1970's, persons having bachelor's degrees in social work will face increasing job competition. Graduates of master's and doctor's degree programs in social work are more qualified for a wider range of jobs including administrative, research, planning, and teaching positions, and are expected to have good opportunities through the mid-1980's.

Because many cities are experiencing financial crises often resulting in budget cuts in human service activities, applicants in these areas may face keen competition. Graduates often prefer to work in major metropolitan areas, since small towns and rural areas offer less opportunity for professional contact with colleagues and have fewer academic institutions for continuing education necessary for advancement. However, job opportunities may be more favorable in rural areas and small towns.

Earnings and Working Conditions

Salaries for social workers at all levels vary greatly by type of agency (private or public, Federal, State, or local) and geographic region. Average earnings for social workers are higher than those for nonsupervisory workers in private industry, except farming. Salaries generally are highest in large cities and in States with sizable urban populations. Private practitioners and those in administration, teaching, and research often earn considerably more than social workers in other settings.

Starting salaries for social case workers (positions requiring a bachelor's degree) in State and local governments averaged about $9,500 in 1976, according to a survey by the International Personnel Management Association; for psychiatric social workers and case work supervisors (positions requiring a master's degree), about $12,000.

The average annual starting salary for social workers (positions requiring an MSW and 1 year of related experience) in hosptials and medical centers was about $12,100 in 1976, according to a survey conducted by the University of Texas Medical School. Top salaries for experienced social workers in these settings averaged $15,600, and some were as high as $25,300.

In the Federal Government, social workers with an MSW and no experience started at $11,523 or $14,097 in 1977. Graduates with a Ph. D. or job experience may start at higher salaries. Most social workers in the Federal Government are employed by the Veterans Administration and the Departments of Health, Education, and Welfare, Justice, and Interior.

Most social workers have a 5-day, 35 to 40-hour week. However, many, particularly in private agencies, work part time. In some agencies, the nature of the duties requires some evening and weekend work, for which compensatory time off is given. Most social work agencies provide fringe benefits such as paid vacation, sick leave, and retirement plans.

Sources of Additional Information

For information about career opportunities in the various fields of social work, contact:

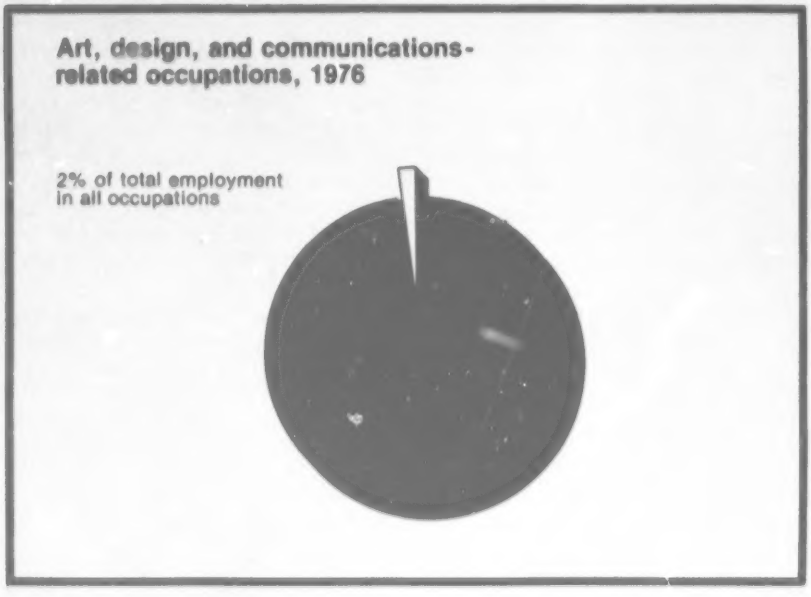
National Association of Social Workers, 1425 H St. NW., Suite 600, Southern Building, Washington, D.C. 20005.

Information on accredited graduate and undergraduate college programs in social work is available from:

Council on Social Work Education, 345 East 46th St., New York, N.Y. 10017.

ART, DESIGN, AND COMMUNICATIONS RELATED OCCUPATIONS

Creativity and the ability to communicate ideas are prerequisites for work in occupations related to art, design, and communications. For example, an architect's blueprint is the embryo of a building; floral designers express a mood of love, sympathy, or other emotion in a flower arrangement; and actors project a character on the stage or screen for the enjoyment of their audiences. Newspaper reporters communicate newsworthy events to their reading audiences; dancers express emotion, mood, or thought through physical movements; and photographers capture an emotion or idea through camera angle, lighting, and the flick of a shutter.



This section of the *Handbook* describes in detail occupations that require creative and communicative talents: The performing arts—actors, dancers, singers, and musicians; the design occupations—architects, photographers, and six other related occupations; and communications-related occupations—interpreters, newspaper reporters, technical writers, and radio and TV announcers.

PERFORMING ARTISTS

The performing arts include the areas of instrumental music, singing, acting, and the dance. Varied as they are, the performing arts have in common the goal of communicating with and affecting the emotions of the audience. Through the media of music, speech, and movement, performing artists attempt to present a moving interpretation of human experience.

Within the performing arts, the number of talented persons seeking employment generally exceeds the number of full-time positions available. As a result, many performers supplement their incomes by teaching, and others work much of the time in different types of occupations.

The difficulty of earning a living as a performer is one fact young persons should remember when they consider such a career. They should consider, therefore, the possible advantages of making their art a hobby rather than a profession. Aspiring young artists usually must spend many years in intensive training and practice before they are ready for public performances. They not only need great natural talent but also determination, a willingness to work long and hard, an overwhelming interest in their chosen field, and some luck.

The statements that follow this introduction give detailed information on musicians, singers, actors, and dancers.

ACTORS AND ACTRESSES

(D.O.T. 150.028 and 150.048)

Nature of the Work

Making a character come to life before an audience is a job that has great glamour and fascination. This demanding work requires special talent and involves many difficulties and uncertanties.

Only a few actors and actresses achieve recognition as stars on the stage, in motion pictures, or on television or radio. A somewhat larger number are well-known, experienced performers, who frequently are cast in supporting roles. However, most actors and actresses struggle for a toehold in the profession, and are glad to pick up parts wherever they can.

New stage actors generally start in "bit" parts where they speak only a few lines. If successful, they may progress to larger, supporting roles. They also may serve as understudies for the principals. Film and television actors, in contrast, may begin in large roles or move into programs from working in commercials.

Actors who prepare for stage, screen, and television roles rehearse many hours. They must memorize their lines and know their cues.

In addition to the actors and actresses with speaking parts, "extras," who have no lines to deliver, are used in various ways in almost all motion pictures and many television shows and theatre productions. In "spectacular" productions, a large number of extras take part in crowd scenes.

Some actors find alternative jobs as coaches of drama or directors of stage, television, radio, or motion picture productions. A few teach in drama departments of colleges and universities.

Places of Employment

About 13,000 actors and actresses worked in stage plays, motion pictures (including films made especially for television), industrial shows, and commercials in 1976.

In the winter, most employment opportunities on the stage are in New York and other large cities. In the summer, stock companies in suburban and resort areas provide employment. In addition, many cities have "little theatres," repertory companies, and dinner theatres, which provide opportunities for local talent as well as for professional actors and actresses. Normally, plays are produced and casts are selected in New York City for shows that go "on the road."

Employment in motion pictures and film television is essentially centered in Hollywood and New York City, although a few studios are located in Miami and other parts of the country. In addition, many films are shot on location, and employ local professionals and nonprofessionals as "day players" and "extras." A number of American-produced films are being shot in foreign countries. In television, most opportunities for actors are at the headquarters of the major networks—in New York, Los Angeles, and, to a lesser extent, Chicago. A few local television stations occasionally employ actors.

Training and Other Qualifications

Young persons who aspire to acting careers should take part in high school and college plays, or work with little theatres and other acting groups for experience.

Formal training in acting, which is increasingly necessary, can be obtained at dramatic art schools, located chiefly in New York, and in hundreds of colleges and universities throughout the country. About 760 colleges and universities confer bachelor's or higher degrees on students who major in dramatic and theater arts. College drama curriculums usually include courses in liberal arts, speech, pantomime, directing, playwriting, play production, and history of the drama, as well as practical courses in acting. From these, the student develops an appreciation of the great plays and a greater understanding of the roles he or she may be called on to play. Graduate degrees in fine arts or drama are needed for college teaching positions.

Acting demands patience and total commitment, since aspiring actors

and actresses must wait for parts or filming schedules, work long hours, and often do much traveling. Flawless performances require the tedious memorizing of lines, which sometimes involves long rehearsal schedules. Other performances, such as television programs, often allow little time for rehearsal, so that the actor must deliver a good performance with very little preparation. The actor needs stamina to withstand the heat of stage or studio lights, or the adverse weather conditions that may exist "on location." Above all, persons who plan to pursue an acting career must have talent and the creative ability to portray different characters. They must have poise, stage presence, and aggressiveness to project themselves to the audience. At the same time, the ability to follow directions is important.

In all media, the best way to start is to use local opportunities and to build on the basis of such experience. Many actors who are successful in local productions eventually try to appear on the New York stage. Modeling experience may also be helpful in obtaining employment in television or motion pictures.

To become a movie extra, one must usually be listed by Central Casting, a no-fee agency that works with the Screen Extras Guild and supplies all extras to the major movie studios in Hollywood. Applicants are accepted only when the number of persons of a particular type on the list—for example, athletic young men, old ladies, or small children—is below the foreseeable need. In recent years, only a very small proportion of the total number of applicants have succeeded in being listed. An actor employed as an extra in a film has very little opportunity to advance to a speaking role in that film.

The length of an actor's or actress's working life depends largely on skill and versatility. Great actors and actresses can work almost indefinitely. On the other hand, employment becomes increasingly limited by middle age, especially for those who become typed in romantic, youthful roles. Due to the factors discussed, persons who intend to pursue an acting career may find unstable employment conditions and financial pressures.

Employment Outlook

Overcrowding has existed in the acting field for many years, and this condition is expected to persist. In the legitimate theater, motion pictures, radio, and television, job applicants greatly exceed the jobs available. Moreover, many actors and actresses are employed in their profession for only a part of the year.

Motion pictures and TV have greatly reduced employment opportunities for actors in the theater. Although a motion picture production may use a very large number of actors during filming, films are widely distributed and may be used for years. Also, some American-produced films are shot in foreign countries, resulting in reduced employment opportunites for American actors and actresses. Television employs a large number of actors on TV programs and commercials. However, employment in this media has been reduced by the FCC ruling that decreased major TV network prime time programming. Local stations often substitute with reruns or with low cost game shows that employ few actors. Also, the trend toward 1- to 2-hour programs and more reruns shortens the period of employment and reduces the number of persons needed.

One possibility for future growth in the legitimate theater lies in the establishment of year-round profes-

Acting demands patience and total commitment.

sional acting companies in cities. The number of such acting groups is growing. The recent growth of summer and winter stock companies, outdoor and regional theatre, repertory companies, and dinner theaters also has increased employment opportunities. In addition, some increases may be likely in the employment of actors on television in response to expansion of the Public Broadcasting System, UHF stations, and cable TV. The development and wider use of video cassettes also may result in some employment opportunities. These media will have a positive influence on employment only if original material and programs result, not reruns or old movies.

Though the field of acting as a whole is expected to grow about as fast as the average for all occupations through the mid-1980's, the number of persons seeking to enter the profession is expected to far exceed available openings. Even highly talented young people are likely to face stiff competition and economic difficulties.

Earnings and Working Conditions

Actors and actresses in the legitimate theater belong to the Actors' Equity Association; in motion pictures, including television films, to the Screen Actors Guild, Inc., or to the Screen Extras Guild, Inc.; in television or radio, to the American Federation of Television and Radio Artists (AFTRA). These unions and the show producers sign basic collective bargaining agreements which set minimum salaries, hours of work, and other conditions of employment. Each actor also signs a separate contract, which may provide for higher salaries than those specified in the basic agreement.

The minimum weekly salary for actors in Broadway productions was about $285 in 1976. Those in small "off-Broadway" theaters received a minimum of $175 a week. For shows on the road, the minimum rate was about $395 a week. (All minimum salaries are adjusted upward automatically, by union contract, commensurate with increases in the cost of living as reflected in the Bureau of Labor Statistics Consumer Price Index.)

In 1976, motion picture and television actors and actresses earned a minimum daily rate of $172.50, or $604 for a 5-day week. For extras, the minimum rate was $52.50 a day. Actors and actresses who did not work on prime time network television received a minimum program fee of about $232.50 for a single program and 8 hours of rehearsal time. Television actors also receive additional compensation for reruns.

However, annual earnings of actors and actresses are adversely affected by the frequent periods of unemployment experienced by many. According to recent surveys by the Actors' Equity Association (which represents actors who work on the stage) and the Screen Actors Guild, almost three quarters of their members earned $2,500 or less a year from acting jobs, and only about 3 percent earned over $25,000 from such work. Because of the frequent periods of unemployment characteristic of this profession, many actors must supplement their incomes by maintaining other, non-acting jobs.

In all fields, many well-known actors and actresses have salary rates above the minimums. Salaries of the few top stars are many times the figures cited.

Eight performances amount to a week's work on the legitimate stage, and any additional performances are paid for as overtime. After the show opens, the basic workweek is 36 hours, including 12 hours for rehearsals. Before it opens, however, the workweek usually is longer to allow time for rehearsals. Evening work is, of course, a regular part of a stage actor's life. Rehearsals may be held late at night and on weekends and holidays. When plays are on the road, weekend traveling often is necessary.

Most actors are covered by a union health, welfare and pension fund, including hospitalization insurance, to which employers contribute. Under some employment conditions, Equity and AFTRA members have paid vacations and sick leave. Most stage actors get little if any unemployment compensation solely from acting since they seldom have enough employment in any State to meet the eligibility requirements. Consequently, when they are between acting jobs they often have to take any casual work they can find.

Sources of Additional Information

Information on colleges and universities and conservatories that offer a major in drama is available from:

American Theater Association, 1029 Vermont Ave., NW., Suite 402, Washington, D.C. 20005.

DANCERS

(D.O.T. 151.028 and 151.048)

Nature of the Work

Dancing is an ancient and worldwide art that has many different forms. Dance movements may be used to interpret an idea or a story, or they may be purely physical expressions of rhythm and sound. Professional dancers may perform in classical ballet or modern dance, in dance adaptations for musical shows, in folk dances, and in other popular kinds of dancing. In addition to being an important art form for its own sake, dance also is used to supplement other types of entertainment, such as opera, musical comedy, and television.

In dance productions, performers most often work as a group. However, a very few top artists do solo work.

Many dancers combine stage work with full-time teaching. A few dancers become choreographers and create new routines. Others are dance directors who train dancers in new productions.

(This statement does not include instructors of ballroom, American or international folk dance, or other social dancing.)

Places of Employment

About 8,000 dancers performed on the stage, screen, and television in 1976. Many others taught in secondary schools, in colleges and universities, in dance schools, and in private studios. A few teachers, trained in

dance therapy, worked in mental hospitals.

Dance teachers are located chiefly in large cities, but many smaller cities and towns have dance schools as well. New York City is the hub for performing dancers. Other large cities that have promising employment opportunities, including major dance companies, include Los Angeles, Chicago, Houston, Salt Lake City, Cincinnati, Miami, San Francisco, Los Angeles, Minneapolis, Seattle, Boston, and Philadelphia.

Training and Other Qualifications

Serious training for a career in dancing traditionally begins by age 12 or earlier. Ballet training is particularly disciplined, and persons who wish to become ballet dancers should begin taking lessons at the age of 7 or 8. Early and intense training also is important for the modern dancer. Most dancers have their professional auditions by age 17 or 18, but training and practice never end. For example, professional ballet dancers take from 10 to 12 lessons a week for 11 or 12 months of the year, and must spend many additional hours practicing.

The early training a dancer receives is crucial to the later skill of the dancer, and therefore the selection of a professional dance school is very important.

Because of the strenuous training required, a dancer's general education may be minimal. However, a dancer should study music, literature, and history, along with the arts to help in the interpretation of dramatic episodes, ideas, and feelings.

Over 115 colleges and universities confer bachelor's or higher degrees in dance. College or university dance degrees are generally offered through the departments of physical education, music, theater, or fine arts.

A college education is not essential to obtaining employment as a professional dancer. In fact, ballet dancers who postpone their first audition until graduation may compete at a disadvantage with younger dancers.

Although a college education is an advantage in obtaining employment as a dance teacher in a college or university, it is of little use for one who teaches professional dance or choreography in a studio situation. Professional schools usually require teachers to have experience as a performer; colleges and conservatories generally require graduate degrees, but experience as a performer often may be substituted. Maturity and a broad educational background also are important.

The dancer's life is one of rigorous practice and self-discipline; therefore patience, perseverence, and a devotion to dance are essential. Good health and physical stamina are necessary, both to keep in good condition and to follow the rugged travel schedule which is often required.

Body height and build should not vary much from the average. Good feet and normal arches also are required. Above all, one must have agility, grace, and a feeling for music, as well as a creative ability to express oneself through dance.

Seldom does a dancer perform unaccompanied. Therefore, young persons who consider dancing as a career should be able to function as part of a team. They also should be prepared to face the anxiety of unstable working conditions brought on by show closings and audition failures.

Because of the strenous nature of the art, young dancers have an advantage over older dancers in competing for jobs. Many dancers retire in their thirties or transfer to related fields such as teaching dance. However, some skillful dancers continue performing beyond the age of 50. Those who become choreographers or dance directors can continue to work as long as persons in other occupations.

The dancer's life is one of rigorous practice and self-discipline.

Employment Outlook

Employment of dancers is expected to grow about as fast as the average for all occupations. However, the number of dancers seeking professional careers will continue to exceed the number of available positions, and competition will be keen. Most employment opportunities will result from replacement needs.

Employment opportunities in stage productions are limited, and competition for such positions is great. Television is partly responsible for the reduction in stage productions, yet at the same time this media offers new outlets for dance. New professional dance companies formed from the increasing number of civic and community groups offer additional employment opportunities. As a result of the increased general popularity of dance in recent years, the best employment opportunities are in teaching dance.

Earnings and Working Conditions

Professional dancers who perform usually are members of one of the unions affiliated with the Associated Actors and Artistes of America (AFL-CIO). Dancers in opera ballet, classical ballet, and the modern dance belong to the American Guild of Musical Artists, Inc.; those on live or videotaped television belong to the American Federation of Television and Radio Artists; those who perform in films and TV belong to the Screen Actors Guild or the Screen Extras Guild, and those in musical comedies join Actors' Equity Association. Other dancers may be members of other unions, depending upon the fields in which they perform. The unions and producers sign basic agreements specifying minimum salary rates, hours of work, and other conditions of employment. However, the separate contract signed by each dancer with the producer of the show may be more fa-

vorable than the basic agreement regarding salary, hours of work, and working conditions.

In 1976, the minimum salary for dancers in opera and other stage productions was about $250 a week. The single performance rate for ballet dancers was about $100 for a solo dance and about $50 per dancer for a group. Dancers on tour received an allowance of $30 a day in 1976 for room and board, with the employer paying the cost of transportation. For a brief appearance in a performance on television or a few days' work in a movie, the minimum rate was higher, relative to time worked. However, this difference was offset by the brevity of the engagement and the long period likely waiting for the next one.

Unemployment rates for dancers are higher than the average for all occupations. Many qualified people cannot obtain year-round work as dancers, and are forced to supplement their incomes by other types of work. Some dancers who are qualified to teach combine teaching with performing.

Salaries of dance teachers vary with the location and the prestige of the school in which they teach. Dance instructors in colleges and universities are paid on the same basis as other faculty members. (See statement on college and university teachers.)

The normal workweek is 30 hours (6 hours per day maximum) spent in rehearsals and matinee and evening performances. Extra compensation is paid for additional hours worked. Most stage performances take place, of course, in the evening, and rehearsals require very long hours, often on weekends and holidays. For shows on the road, weekend travel often is required.

Dancers are entitled to some paid sick leave and various health and welfare benefits provided by their unions, to which the employers contribute. Dance instructors in schools receive benefits comparable to those of other teachers.

Sources Of Additional Information

Information on colleges and universities that give a major in the dance or some courses in the dance, as well as details on the types of courses and other pertinent information is available from:

National Dance Association, a division of the American Alliance for Health, Physical Education and Recreation, 1201 16th St. NW., Washington, D.C. 20036.

For information on all aspects of dance, counseling services, and job listings, contact:

American Dance Guild, 1619 Broadway, Room 603, New York, N.Y. 10019.

MUSICIANS

(D.O.T. 152.028 and .048)

Nature of the Work

The important role that music plays in most people's lives makes it difficult to imagine a world without musicians. Professional musicians are those whose livelihoods depend upon performing for the enjoyment of others. These professionals—whether they play in a symphony orchestra, dance band, rock group, or jazz combo—generally have behind them many years of formal or informal study and practice. As a rule, musicians specialize in either popular or classical music; only a few play both types professionally.

Musicians who specialize in popular music usually play the trumpet, trombone, clarinet, saxophone, organ, or one of the "rhythm" instruments—the piano, string bass, drums, or guitar. Dance bands play in nightclubs, restaurants, and at special parties. The best known bands, jazz groups, rock groups, and solo performers sometimes perform on television.

Classical musicians play in symphonies, opera, ballet and theater orchestras, and for other groups that require orchestral accompaniments. These musicians play string, brass, woodwind or percussion instruments. Some form small groups—usually a string quartet or a trio—to give concerts of chamber music. Many pianists accompany vocal or instrumental soloists, choral groups, or provide background music in restaurants or other places. Most organists play in churches; often they direct the choir.

A few exceptional musicians give their own concerts and appear as soloists with symphony orchestras. Both classical and popular musicians make individual and group recordings.

In addition to performing, many musicians teach instrumental and vocal music in schools and colleges, or give private lessons in their own studios or in pupils' homes. Others combine careers as performers with work as arrangers and composers.

Since a high quality of performance requires constant study and practice, self-discipline is vital.

A few musicians specialize in library science or psychology for work in music libraries or in the field of music therapy in hospitals. Others work as orchestra conductors or band directors.

Places of Employment

About 127,000 persons worked as performing musicians in 1976. Many thousands more taught in elementary and secondary schools and in colleges and universities. (See the statements on teachers elsewhere in the *Handbook*.) Almost every town and city has at least one private music teacher.

Most performing musicians work in cities where entertainment and recording activities are concentrated, such as New York, Chicago, Los Angeles, Nashville, Miami Beach, and New Orleans. Many perform with one of the 31 major symphony groups, the 76 metropolitan orchestras, or the hundreds of community orchestras. Many communities have orchestras and dance bands which offer at least part-time work. The various branches of the Armed Forces also offer career opportunities in a number of different musical organizations.

Training and Other Qualifications

Most people who become professional musicians begin studying an instrument at an early age. To acquire great technical skill, a thorough knowledge of music, and the ability to interpret music, young people need intensive training through private study with an accomplished musician, in a college or university which has a strong music program, or in a conservatory of music. For advanced study in one of these institutions, an audition frequently is necessary. Many teachers in these schools are accomplished artists who will train only promising young musicians.

Almost 500 colleges, universities, and music conservatories offer bachelor's and/or higher degrees in instrumental or vocal music. These programs provide training in musical performance, composition, and theory, and also offer liberal arts courses. In addition, about 750 conservatories and colleges and universities offer a bachelor's degree program in music education to qualify graduates for the State certificate for elementary and secondary school teaching positions. College teaching positions usually require advanced degrees, but exceptions may be made for well-qualified artists.

Musicians who play popular music must have an understanding of and feeling for that style of music, but classical training may expand their employment opportunities. As a rule, they take lessons with private teachers when young, and seize every opportunity to play in amateur or professional performances. Establishing a reputation with other musicians is very important in getting started in a career in popular music. Some young people form small dance bands or rock groups. As they gain experience and become known, they may audition for other local bands, and still later, for the better known bands and orchestras.

Young persons who consider careers in music should have musical talent, versatility, creative ability, and poise and stage presence to face large audiences. Since quality of performance requires constant study and practice, self-discipline is vital. Moreover, musicians who do concert and nightclub engagements must have physical stamina because of frequent traveling and schedules that often include night performances.

Employment Outlook

Employment of musicians is expected to grow about as fast as the average through the mid-1980's, but competition for jobs will be keen. Opportunities for concerts and recitals are not numerous enough to provide adequate employment for all the pianists, violinists, and other instrumentalists qualified as concert artists. Competition usually is keen for positions that offer stable employment, such as jobs with major orchestras, with the Armed Forces, and in teaching positions. Because of the ease with which a musician can enter private music teaching, the number of music teachers has been more than sufficient and probably will continue to be. Although many opportunities are expected for single and short-term engagements, playing popular music in night clubs and theaters, the supply of qualified musicians who seek such jobs is likely to exceed demand. On the other hand, first-class, experienced accompanists and outstanding players of stringed instruments are likely to remain relatively scarce.

Earnings and Working Conditions

The amount received for a performance by either classical or popular musicians depends on their geographic location as well as on their professional reputation. Minimum salaries for musicians in the 31 major symphony orchestras in the United States in 1976 ranged from $200 to $400 a week, according to the American Symphony Orchestra League. Minimum wages for musicians in metropolitan symphony orchestras were generally between $20 and $40 per concert. Some musicians earned substantially more than the minimums, however.

The major symphony orchestras have seasons ranging from 45 to 52 weeks. About half of them have 50- to 52-week seasons. Few of the metropolitan or community orchestras have seasons of 50 to 52 weeks, however.

Musicians in large metropolitan areas who played at dances, club dates, variety shows, ballets, musical comedies, concerts, and industrial shows generally earned minimums ranging from $40 to $53 for 3 hours of work. Musicians in these areas who had steady engagement contracts earned between $6 and $8 per hour for a 5-day week. Wages for the same types of engagements tended to be less in smaller cities and towns. Musicians employed in motion picture recording earned a minimum of $93 for a 3-hour session; those employed in television commercials earned a minimum of $48 for a 1-hour session. Musicians employed by manufacturers of phonograph recordings were paid a minimum of $110 for a 3-hour session.

Music teachers in public schools earn salaries comparable to those of other teachers. (See statements on elementary and secondary school teachers elsewhere in the *Handbook*.)

Many teachers give private music lessons to supplement their earnings. However, earnings often are uncertain and vary according to the musician's reputation, the number of teachers and students in the locality, and the economic status of the community.

Musicians customarily work at night and on weekends, and they must spend considerable time in practice and in rehearsal. Performing engagements usually require some travel.

Many musicians, primarily those employed by symphony orchestras, work under master wage agreements, which guarantee a season's work up to 52 weeks. Musicians in other areas, however, may face relatively long periods of unemployment between jobs. Thus, their earnings generally are lower than those of many other occupations. Moreover, since they may not work steadily for one employer, some performers cannot qualify for unemployment compensation, and few have either sick leave or vacations with pay. For these reasons, many musicians take other types of jobs to supplement their earnings as musicians.

Most professional musicians belong to the American Federation of Musicians (AFL-CIO). Concert soloists also belong to the American Guild of Musical Artists, Inc. (AFL-CIO).

Sources of Additional Information

For information about wages, hours of work, and working conditions for professional musicians, contact:

American Federation of Musicians (AFL-CIO), 1500 Broadway, New York, N.Y. 10036.

Information about the requirements for certification of organists and choir masters is available from:

American Guild of Organists, 630 Fifth Ave., New York, N.Y. 10020.

A list of accredited schools of music and degree programs offered is available from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

Further information about careers in music is available from:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

A book entitled *Careers in Music* can be obtained for $1 from:

American Music Conference, 150 E. Huron, Chicago, Ill. 60611.

SINGERS

(D.O.T. 152.028 and .048)

Nature of the Work

Singing is an age-old form of communication which, in one form or another, can be understood and appreciated by almost everyone. Professional singing often requires not only a fine voice but also a highly developed technique and a broad knowledge of music. A small number of singing stars make recordings or go on concert tours in the United States and abroad. Somewhat larger numbers of singers obtain leading or supporting roles in operas and popular music shows, or secure engagements as concert soloists in oratorios and other types of performances. Some singers also become members of opera and musical comedy choruses or other professional choral groups. Popular music singers perform in musical shows of all kinds—in the movies, on the stage, on radio and television, in concerts, and in nightclubs and other entertainment places. The best known popular music singers make and sell many recordings.

Some singers combine their work as performers with other related jobs. Many give private voice lessons. A number of singers teach and direct choruses in elementary and secondary schools. (See the statements on teachers elsewhere in the *Handbook*.) Others give voice training or direct choral groups in churches, music conservatories, or colleges and universities.

Places of Employment

About 23,000 persons worked as professional singers in 1976. Many others were employed as music teachers in elementary and secondary schools, colleges, universities, and conservatories throughout the country. Opportunities for singing engagements are concentrated mainly in New York City, Los Angeles, Las Vegas, San Francisco, Dallas, and Chicago—the Nation's chief entertainment centers. Nashville, Tennessee, a major center for country and western music, is one of the most important places for employment of singers for "live" performances and recordings. Many singers work part time as church singers and choirmasters.

Training and Other Qualifications

Persons who want to sing professionally should acquire a broad background in music, including its theory and history. The ability to dance may be helpful, since singers sometimes are required to dance. In addition, those interested in a singing career should start piano lessons at an early age to become familiar with music theory and music composition. As a rule, voice training should not begin until after the individual has matured physically, although young boys who sing in church choirs receive some training before their voices change. An audition often is required for advanced voice training. Since voice training often continues for years after the singer's professional career has started, a prospective singer must have great determination.

To prepare for careers as singers of classical music, young people can take private voice lessons or enroll in a music conservatory or a school or department of music in a college or university. These schools provide voice training and training in understanding and interpreting music, including music-related training in foreign languages and, sometimes, dramatic training. After completing 4 years of study, the graduate may receive the degree of bachelor of music, bachelor of science or arts (in music), or bachelor of fine arts.

Singers who plan to teach in public schools need at least a bachelor's degree in music and must meet the State certification requirements for teachers. About 750 conservatories and colleges and universities offer a bachelor's degree program in music

Young people who want to sing professionally should acquire a broad background in music.

education. In addition, almost 500 colleges and universities offer training in musical performance, composition, and theory, leading to a bachelor's degree. Most college teachers must have a master's degree or Ph. D. degree, but exceptions may be made for well-qualified artists.

Although voice training is an asset for singers of popular music, many with untrained voices have had successful careers. The typical popular song does not demand that the voice be developed to cover as wide a range on the musical scale as does classical music, and the lack of voice projection may be overcome by use of a microphone.

Young singers of popular songs may become known by participating in local amateur and paid shows. These engagements may lead to employment with local dance bands or rock groups and possibly later with better known ones.

In addition to musical ability, a singing career requires an attractive appearance, poise and stage presence, and perseverance. Singers also must have physical stamina to adapt to frequent traveling and rigorous time schedules, which often include night performances.

Employment Outlook

Employment of singers is expected to grow about as fast as the average through the mid-1980's, but competition for jobs will be keen. Many short-term jobs are expected in the opera and concert stage, movies, theater, nightclubs, and other areas. The demand is growing for singers who record popular music to do radio and television commercials. However, these short-term jobs are not enough to provide steady employment for all qualified singers.

Earnings and Working Conditions

Singers generally work at night and on weekends, and must spend much time in practice and in rehearsals. Work in the entertainment field is seasonal and few performers have steady jobs. Except for a few well-known concert soloists, opera stars, top recording artists of popular music, and some dance band singers, most professional singers experience difficulty in obtaining regular employment and have to supplement their incomes with other kinds of jobs. Moreover, a singing career sometimes is relatively short, since it depends on a good voice, physical stamina, and public acceptance of the artist, all of which may be affected by age.

Concert singers who were part of a chorus earned a minimum daily rate of $25 in 1976, or $45 to $50 per performance. Members of an opera chorus earned a minimum daily rate of $30, or $40 per performance. A featured soloist received a minimum of $200 for each performance. A few opera soloists and popular singers, however, earned thousands of dollars per performance. Minimum wage rates for singers on television ranged from around $143 to about $161 per singer for a 1-hour show, depending on the number of singers in the group.

Professional singers usually belong to a branch of the AFL-CIO union, the Associated Actors and Artistes of America. Singers on the concert stage or in opera belong to the American Guild of Musical Artists, Inc.; those who sing on radio or live television or make phonograph recordings are members of the American Federation of Television and Radio Artists; singers in the variety and nightclub field belong to the American Guild of Variety Artists; those who sing in musical comedy and operettas belong to the Actors' Equity Association; and those who sing in the movies belong to the Screen Actors Guild, Inc.

Sources of Additional Information

Information about accredited schools and departments of music is available from:

National Association of Schools of Music, 11250 Roger Bacon Dr., Reston, Va. 22090.

Further information about careers in music is available from:

Music Educators National Conference, 1902 Association Dr., Reston, Va. 22091.

DESIGN OCCUPATIONS

Good design can improve the appearance and usefulness of the products that we use and the places where we live and work, as well as increase sales by improving their "eye appeal." Making products or places more appealing and functional and bringing them to the attention of the public is the job of people in design occupations.

Different design careers require varying levels of training and education. For example, while floral designers often learn their duties on the job and do not need a high school diploma, architects must have at least 5 years of college and professional education. Regardless of the amount of formal training required, people in design occupations should be creative and be able to communicate ideas through their designs and displays.

Job opportunities in design occupations are expected to increase through the mid-1980's, primarily because a growing and more affluent population is becoming more design conscious.

This chapter describes 8 design occupations: architects, commercial artists, display workers, floral designers, industrial designers, interior designers, landscape architects, and photographers. (Other jobs that often require design skills—for example, engineers—are described elsewhere in the *Handbook*.)

ARCHITECTS

(D.O.T. 001.081)

Nature of the Work

Attractive buildings improve the physical environment of a community. But buildings also must be safe and must allow people both inside and around them to perform their duties properly. Architects design buildings that successfully combine these elements of attractiveness, safety, and usefulness.

Most architects provide professional services to clients planning a building project. They are involved in all phases of development of a building or project, from the initial discussion of general ideas to the final piece of construction. Their duties require a variety of skills—design, engineering, managerial, and supervisory.

The architect and client first discuss the purposes, requirements, and cost of a project, as well as any preference in design that the client may have. The architect then prepares schematic drawings to show the scale and structural relationships of the building.

If the schematic drawings are accepted, the architect develops a final design showing the floor plans and the structural details of the project. For example, in designing a school, the architect determines the width of corridors and stairways so that students may move easily from one class to another; the type and arrangement of storage space, and the location and size of classrooms, laboratories, lunchroom or cafeteria, gymnasium, and administrative offices.

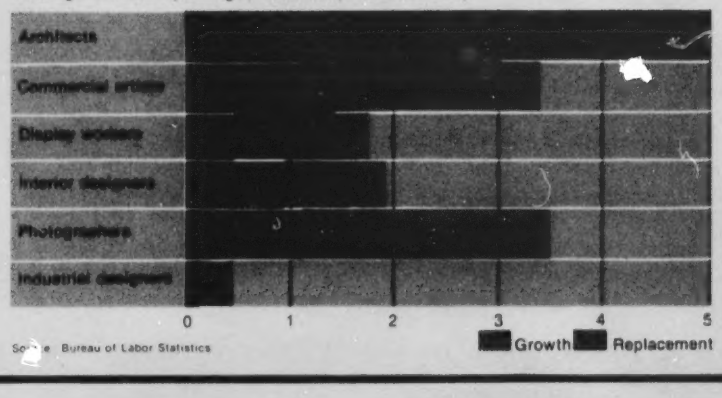
Next the architect prepares working drawings showing the exact dimensions of every part of the structure and the location of plumbing, heating units, electrical outlets, and air conditioning.

Architects also specify the building materials, and, in some cases, the interior furnishings. In all cases, the architect must insure that the structure's design and specifications conform to local and State building codes, zoning laws, fire regulations, and other ordinances.

Throughout this time, the architect may make changes to satisfy the client. A client may, for example, decide that an original house plan is too expensive and ask the architect to make modifications. Or clients may decide that their own ideas are more appealing than those of the architect. As a result, architects could become frustrated, redesigning their plans to meet the clients' expectations.

After all drawings are completed, the architect assists the client in selecting a contractor and negotiating

Although architects have the largest number of job opportunities within the design field, job opportunities also will occur in other occupations as well



the contract. As construction proceeds, the architect makes periodic visits to the building site to insure that the contractor is following the design, using the specified materials, and meeting the specified quality standards. The job is not completed until construction is finished, all required tests are made, bills are paid, and guarantees are received from the contractor.

Architects design a wide variety of structures such as houses, churches, hospitals, office buildings, and airports. They also design multibuilding complexes for urban renewal projects, college campuses, industrial parks, and new towns. Besides designing structures, architects also may help in selecting building sites, preparing cost and land-use studies, and long-range planning for site development.

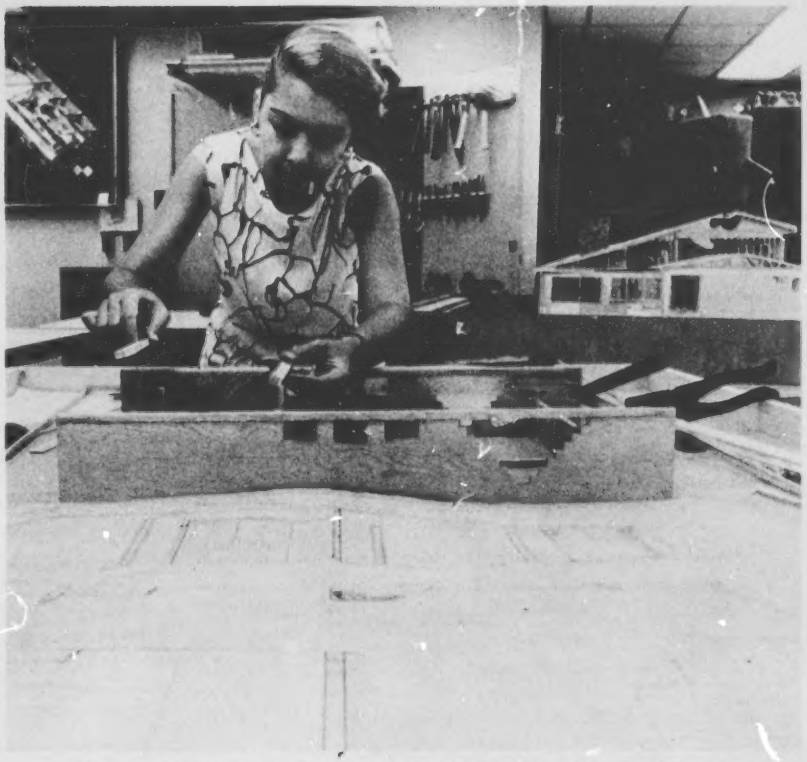
When working on large projects or for large architectural firms, architects often specialize in one phase of the work such as designing, or administering construction contracts. This often requires working with engineers, urban planners, landscape architects, and other design personnel.

Places of Employment

About 50,000 registered (licensed) architects were employed in 1976. In addition, many unlicensed architectural school graduates also work as architects, but they must work under the supervision of licensed architects.

Most architects work in architectural firms, for builders, for real estate firms, or for other businesses that have large construction programs. Some work for government agencies, often in city and community planning or urban redevelopment. About 1,300 architects work for the Federal Government, mainly for the Departments of Defense, Housing and Urban Development, and the General Services Administration.

Although found in many areas, a large proportion of architects are employed in seven cities: Boston, Chicago, Los Angeles, New York, Philadelphia, San Francisco, and Washington.



New graduates usually begin as junior drafters in architectural firms.

Training, Other Qualifications, and Advancement

All States and the District of Columbia require architects to be licensed. To qualify for the 2-day licensing exam, a person must have either a bachelor of architecture degree followed by 3 years of experience in an architect's office or a master of architecture degree followed by 2 years of experience. As a substitute for formal training, most States accept additional experience (usually 12 years) and successful completion of a qualifying test for admission to the licensing examination. Many architectural school graduates work in the field even though they are not licensed. However, a registered architect is required to take legal responsibility for all work.

In 1976, the National Architectural Accrediting Board had accredited 80 of the 101 schools offering professional degrees in architecture. Most of these schools offer a 5-year curriculum leading to a Bachelor of Architecture degree or a 6-year curriculum leading to a Master of Architecture degree. Students also may transfer to professional degree programs after completing a 2-year junior or community college program in architecture. Many architectural schools also offer graduate education for those who already have their first professional degree. Although such training is not essential for practicing architects, it often is desirable for those in research and teaching. A typical college architectural program includes courses in architectural theory, design, graphics, engineering, and urban planning, as well as in English, mathematics, chemistry, sociology, economics, and a foreign language.

Persons planning careers in architecture should be able to work independently, have a capacity for solving technical problems, and be artistically inclined. They also must be prepared to work in the competitive environment of business where leadership and ability to work with others are important. Working for architects or building contractors dur-

ing summer vacations is useful for gaining practical knowledge.

New graduates usually begin as junior drafters in architectural firms, where they prepare architectural drawings and make models of structures under the direction of a registered architect. After several years of experience, they may advance to chief or senior drafter responsible for all major details of a set of working drawings and for supervising other drafters. Others may work as designers, construction contract administrators, or specification writers who prepare directions explaining the architect's plan to the builder. Employees who become associates in their firms receive, in addition to a salary, a share of the profits. Usually, however, the architect's goal is to own his or her own business.

Employment Outlook

Architects are expected to face competition for jobs through the mid-1980's. Although employment of architects is expected to rise about as fast as the average for all workers during this period, the number of degrees granted in architecture also has been increasing rapidly. If this trend continues, the number of people seeking employment in the field could exceed the number of openings from growth, deaths, and retirements. The best employment prospects are expected to occur in the South and in those States which do not have architectural schools.

The outlook for these workers may change, however, during short-run periods. Because the demand for architects is highly dependent upon the level of new construction, any significant upsurge or downturn in building could temporarily alter demand.

Most job openings are expected to be in architectural firms but some openings are also expected to occur in colleges and universities, construction firms, and the Government.

The major factor contributing to the increase in employment of architects is the expected rapid growth of nonresidential construction. In addition, the projected increase in enrollments in architectural programs should result in additional requirements for architects to teach in colleges and universities.

Growing public concern about the quality of the physical environment is expected to increase the demand for urban redevelopment and city and community environmental planning projects. This should create further opportunities for employment. (See statement on urban planners elsewhere in the *Handbook*.)

Earnings and Working Conditions

The average salary for architects in 1976 was well over $20,000, according to the limited information available. Architects with well-established private practices generally earn much more than even highly paid salaried employees of architectural firms. Although the range in their incomes is very wide, some architects with many years of experience and good reputations earned well over $35,000 a year. Architects starting their own practices may go through a period when their expenses are greater than their income. Annual income may fluctuate due to changing business conditions.

In 1977, the average salary for architects working in the Federal Government was about $23,000.

Most architects spend long hours at the drawing board in well equipped offices. An architect sometimes has to work overtime to meet a deadline. The routine often is varied by interviewing clients or contractors and discussing the designs, construction procedures, or building materials of a project with other architects or engineers. Contract administrators frequently work outdoors during inspections at construction sites.

Sources of Additional Information

General information about careers in architecture, including a catalog of publications, can be obtained from:

The American Institute of Architects, 1735 New York Ave. NW., Washington, D.C. 20006.

Information about schools of architecture and a list of junior colleges offering courses in architecture are available from:

The Association of Collegiate Schools of Architecture, Inc., 1735 New York Ave. NW., Washington. D. C. 20006.

Information about the licensing examinations can be obtained from:

The National Council of Architectural Registration Boards, 1735 New York Ave. NW., Suite 700, Washington, D.C. 20006.

COMMERCIAL ARTISTS

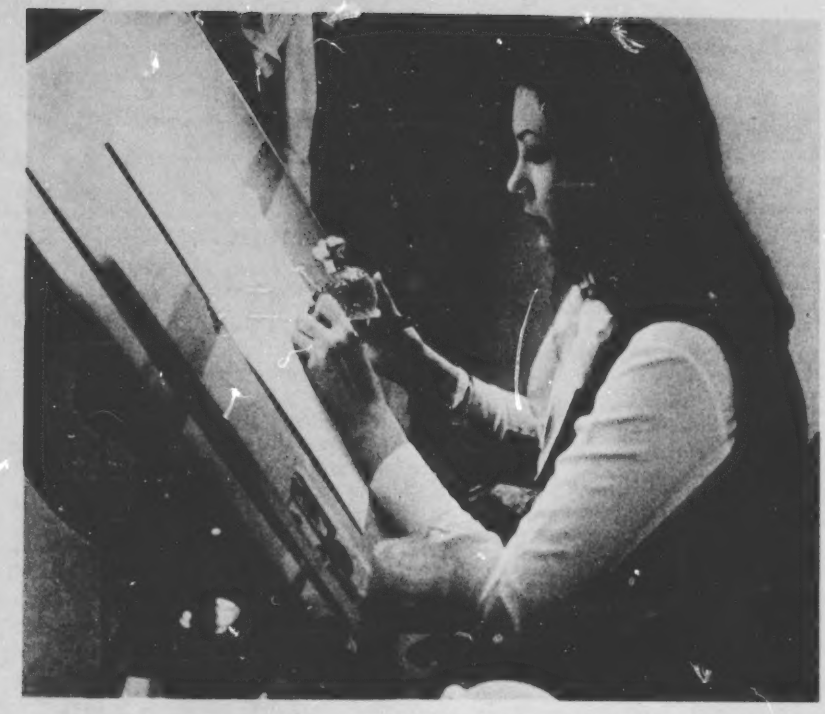
(D.O.T. 141.031 and .081, 970.281 and .381, and 979.381)

Nature of the Work

A team of commercial artists with varying skills and specializations often creates the artwork in newspapers and magazines and on billboards, brochures, and catalogs. This team is supervised by an art director, whose main function is to develop a theme or idea for an ad or an advertising campaign. After the art director has determined the main elements of an ad or design, he or she will turn it over to two specialists for further refinement. The *sketch artist*, also called a *renderer*, does a rough drawing of any pictures required. The *layout artist*, who is concerned with graphics rather than art work, constructs or arranges the illustrations or photographs, plans the typography and picks colors for the ad. What emerges is a "rough visual," a sketch of the finished ad. Both the sketch artist and the layout artist work closely with the art director; they may do several sketches or rough visuals before the director is satisfied.

Other commercial artists, usually with less experience, are needed to turn out the finished product. *Letterers* put together headlines and other words on the ad. They use set or photo lettering, and must have a knowledge of type faces and the ability to reproduce them in a variety of sizes and mediums such as ink, pencil, or cutout pieces of paper. *Mechanical artists* paste up an engraver's guide of the ad with all the elements in the exact size and place in which they will finally appear. Since this pasteup will be the engraver's blueprint, mechanical artists must be very precise.

Pasteup artists and other beginners do more routine work such as cutting



Some salaried commercial artists also do freelance work in their spare time.

mats, assembling booklets, or running errands.

In a small office, the art director may perform the layout and more routine work with the help of trainees. In a large office, however, the art director develops concepts with the copywriter; sets standards; deals with clients; and purchases needed photographs, illustrations, lettering, and other artwork from freelancers.

Advertising agencies or advertising departments who lack time or personnel hire *freelance illustrators* to prepare sketches. These artists must be highly talented and able to work quickly—an agency, for example, may require a finished sketch in 1 day. Only the highly talented will receive enough assignments to maintain a sufficient income.

Advertising artists create the concept and artwork for a wide variety of items. These include direct mail advertising, catalogs, counter displays, slides, and filmstrips. They also design or lay out the editorial pages and features of newspapers and magazines and produce or purchase the necessary illustrations or artwork. Some commercial artists specialize in producing fashion illustrations, greeting cards, or book illustrations, or in making technical drawings for industry.

Places of Employment

About 67,000 persons worked as commercial artists in 1976. Although some commercial artists can be found in nearly every city, the majority work in large cities, such as New York, Los Angeles, Boston, Washington, D.C., and Chicago, where the largest users of commercial art are located.

Most commercial artists work as staff artists for advertising departments of large companies, advertising agencies, printing and publishing firms, textile companies, photographic studios, television and motion picture studios, department stores, and a variety of other business organizations. Many are self-employed or freelance artists. Some salaried commercial artists also do freelance work in their spare time. A few thousand commercial artists work for Federal Government agencies, principally in the Defense Department. A few teach in art schools.

Training, Other Qualifications, and Advancement

Artistic ability, imagination, neatness, and a capacity to visualize ideas on paper are important qualifications for success in commercial art. However, these qualities may be developed by specialized training in the techniques of commercial and applied art.

Persons can prepare for a career in commercial art by attending a 2- or 4-year trade school, or a junior college, college, or university which offers a program in commercial art. In 1976, about 900 institutions offered instruction in commercial art.

Most artists who enter the field are graduates of trade schools. Admission to these schools is based upon high school grades, a portfolio of art work, and an interview. A growing number of colleges and universities, however, confer degrees in commercial art. These college programs supplement art instruction with liberal arts courses such as English or history. Although many employers prefer graduates of a college or university program in commercial art, the quality and reputation of a particular program is more important than the type of institution offering it.

Limited training in commercial art also may be obtained through public vocational high schools and practical experience on the job. There is no formal training program for the commercial art trainee, however. Instead, trainees may run errands for the art director or do other general chores while learning. Additional training usually is needed for advancement. Beginners also should supplement their formal education and training by making posters, layouts, illustrations, and similar projects for schools and other organizations.

The first year in art school may be spent studying fundamentals—perspective, design, color harmony, composition—and the use of pencil, crayon, pen and ink, and other art media. Subsequent study, generally more specialized, includes drawing from life, advertising design, graphic design, lettering, typography, illustrations, and other courses in the student's particular field of interest.

In order to advance beyond a be-

ginner's job, commercial artists must develop specialized skills. For example, letterers and retouchers must do precise and detailed work that requires excellent coordination. A sketch artist must be able to draw anything adequately in almost any medium, including die marker, pencil, ink or transparencies. Most commercial artists advance by specializing either in the mechanical elements of producing an ad (letterers and mechanical and layout artists) or in the pictorial elements (sketch artists and illustrators). Thus, a successful sketch artist may not be very skilled in typography. Art directors, however, need a strong educational background in art and business practices in addition to experience with photography, typography, and printing production methods. Advertising art directors require a special kind of creativity—the ability to conceive ideas that will stimulate the sale of the client's products or services.

Commercial artists usually assemble their best artwork into a "portfolio," to display their work. A good portfolio is essential for initial employment, for freelance assignments, and for job changes.

Employment Outlook

Talented and well-trained commercial artists may face competition for employment and advancement in most kinds of work through the mid-1980's. Those with only average ability and little specialized training are likely to encounter keen competition for beginning jobs and have very limited opportunities for advancement.

Employment of commercial artists is expected to increase about as fast as the average for all occupations through the mid-1980's. One anticipated area of growth is in visual advertising such as television graphics, packaging displays, and poster and window displays. The expanding field of industrial design also is expected to require more qualified artists for three-dimensional work with engineering concepts. (See statement on industrial designers.) In addition, a few thousand jobs for commercial artists are expected to open each year throughout the period to replace workers who will die, retire, or leave the field for other reasons.

The demand for commercial artists is expected to vary by specialization or type. For example, demand for freelance artists is expected to increase and experienced paste-up and mechanical artists are always needed; jobs for art directors and layout artists, however, will be fewer, much sought after, and open only to experienced, very talented, and creative artists. Employment opportunities are expected to be best for those who have a variety of skills rather than expertise in one or two specialties.

Commercial art occupations are particularly sensitive to changes in business conditions. Therefore, jobseekers may find that opportunities vary from year to year depending upon economic conditions.

Earnings and Working Conditions

In 1976, beginning commercial artists having no training beyond vocational high school typically earned from $90 to $110 a week; graduates of 2-year professional schools, $100 to $125 a week; and graduates of 4-year post-high school programs, $120 to $175 a week, according to the limited data available. Talented artists who had strong educational backgrounds and good portfolios, however, started at higher salaries. After a few years of experience, qualified illustrators may expect to earn $185 to $300 a week. Art directors, executives, well-known freelance illustrators, and others in top positions generally have much higher earnings, from $480 to $580 a week or more.

Earnings of freelance artists vary widely, since they are affected by factors such as skill level, variety, and popularity of work. Freelance artists may be paid by the hour or by the assignment. Commercial artists who worked for the Federal Government in 1977 had an average annual salary of $15,550 or about $300 a week.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes they must work additional hours under considerable pressure to meet deadlines. Freelance artists usually have irregular working hours.

Sources of Additional Information

Information on institutions offering programs in commercial art is available from:

National Art Education Association, National Education Association, 1916 Association Dr., Reston, Va. 22091.

DISPLAY WORKERS (RETAIL TRADE)

(D.O.T. 298.081)

Nature of the Work

It happens every shopping day: A person browsing through a clothing store notices a mannequin wearing an attractive suit and, without having planned to, purchases a similar outfit. A fishing enthusiast sees a display of angling equipment in a store window, goes in, and buys a new reel.

Incidents like these show how displays in stores and store windows can attract customers and encourage them to buy. Knowing the effectiveness of this form of advertising, some stores allot a large share of their publicity budget to displays.

Display workers specialize in designing and installing such exhibits. Their aim is to develop attractive, eye-catching ways of showing store merchandise to best advantage. To create a setting that enhances the merchandise, display workers need imagination as well as knowledge of color harmony, composition, and other fundamentals of art. They may, for example, choose a theme—a beach setting to advertise bathing suits or surfing equipment—and design a colorful display around this theme. After the design has been approved by the store's management, display workers obtain the props and other necessary accessories. Their craft skills come into play at this time.

Display workers often construct many of the props themselves using hammers, saws, spray guns, and other tools. They may be assisted in these tasks by a helper or by store maintenance workers. Sometimes display workers use merchandise

from other departments of the store as props. Display workers also may use props out of storage, designed for previous displays, or order props from firms that specialize in them. The display workers install the props, background settings, and lighting equipment. They also dress mannequins and add finishing touches. Periodically, they dismantle and replace old displays with new ones.

In large stores that employ many display workers, each may specialize in a particular activity such as carpentry, painting, making signs, or setting up interior or window displays. Overall planning and administration in large stores are usually the responsibilities of a display director who supervises and coordinates the activities of each department. The director confers with executives, such as advertising and sales managers, to select merchandise for promotion and to plan displays.

Places of Employment

About 36,000 persons worked as display workers in retail stores in 1976. Most worked in department, clothing, and homefurnishing stores; others in variety, drug, and shoe stores and in book and gift shops. Several thousand additional freelance or self-employed display workers serviced small stores that needed professional window dressing but could not afford full-time display workers.

Geographically, employment is distributed much like the Nation's population, with most jobs in large towns and cities.

Display workers need imagination as well as knowledge of color harmony.

Training, Other Qualifications, and Advancement

Most display workers learn their trade through informal on-the-job training. Beginners are hired as helpers to dismantle displays, carry props, and do other routine tasks. Gradually, they are given the opportunity to do more difficult work such as building props and, if they show artistic talent, planning simple designs. A beginner usually can become skilled in 1 to 2 years. Training time varies, however, depending on the beginner's ability and the variety and complexity of displays that the employer requires.

When hiring inexperienced workers, most employers will consider only high school graduates. Courses that provide helpful training for display work include art, woodworking, mechanical drawing, and merchandising. Some employers seek applicants who have completed college courses in art, interior decorating, fashion design, advertising, or related subjects.

Creative ability, manual dexterity, and mechanical aptitude are among the most important personal qualifications needed in this field. Good physical condition and agility are needed to carry equipment, climb ladders, and work in close quarters without upsetting props.

Advancement may take several forms. A display worker with supervisory ability might become display director in a large store. A display director might in turn progress to sales promotion director or be placed in charge of store planning.

Freelance work is another avenue of advancement. Relatively little money is needed to start a freelance business. However, this is a highly competitive field, and self-employ-

ment may be a struggle at the outset unless an excellent reputation has first been established. For this reason, some workers moonlight until they have enough clients for full-time work on their own.

The display worker's skills could lead to jobs in other art-related occupations such as interior decoration or photography. These occupations, however, require additional training.

Employment Outlook

Employment of display workers is expected to grow more slowly than the average for all occupations through the mid-1980's. Greater overall coordination of activities by store managements and increased specialization of job duties will tend to limit the number of display workers needed in each store. In addition to the jobs resulting from employment growth, however, many openings will arise each year to replace experienced workers who retire, die, or transfer to other occupations.

Employment opportunities will continue to be concentrated in large stores, most of which are located in metropolitan areas.

Earnings and Working Conditions

Among large employers, wages for beginners ranged from $2.50 to $3.75 an hour in 1976. Beginners who have completed college courses in art, interior decorating, or related subjects generally received the higher starting salaries. Experienced display workers' salaries ranged from $120 to $240 a week, depending largely on experience and ability. Most display directors earned between $12,000 and $20,000 a year. Experienced directors in large metropolitan department stores, particularly executives, may earn considerably more.

The earnings of freelancers depend on their talent and prestige, on the number and kinds of stores they service, and on the amount of time they work. Many highly skilled freelancers earn more than $25,000 a year.

Display personnel enjoy the satisfaction of doing creative work. Transforming an original design into reality can be a highly rewarding experience.

Display workers usually work 35 to 40 hours a week. During busy seasons, such as Christmas and Easter, they may work overtime, nights, and weekends to prepare special displays.

Constructing and installing props frequently require prolonged standing, bending, stooping, and working in awkward positions. Display workers risk injury from falls off ladders, from contact with sharp or rough materials, and from the use of power tools, but serious injuries are uncommon.

Sources of Additional Information

Details on career opportunities can be obtained from local retailers, such as department stores, and from local offices of the State employment service.

FLORAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

Floral designers assemble flowers and foliage into a specific design to express the thoughts and sentiments of the sender. In performing their work, floral designers combine their knowledge of flower and plant forms and floral design techniques with their own creativity to produce floral and plant gifts, decorations, and tributes.

Designers must know the names and lasting qualities of flowers, and growing information about flowering plants. They must also know the seasonal availability of flower and plant materials and the management's pricing structure for these materials.

In any given day, designers may receive a variety of orders including decorative flowering plants, bouquets, corsages, funeral work, and dried flower arrangements. Special orders, such as for weddings and parties, also incorporate the creative design and decorating talents of the floral designer.

Designers work from a written order indicating customer preference for color and type of flower, as well as the occasion, price, date, time, and place the arrangement or plant is to be delivered. Customers sometimes leave the choice of flowers, color, and design to the discretion of the designer, however.

A funeral order may read "easel spray of red and white flowers." For the foundation, the designer attaches a base (styrofoam, needle pack, etc.) near the top of a three-legged wire stand. Appropriate flowers are selected from the floral refrigerator. White gladiolas and red carnations are a possible combination. The price of the order and the cost of the flowers determine the number of flowers used. The flowers are cut to the needed length and wired for security. Stems are strengthened with wood sticks for easy insertion into the base.

To provide a background for the flowers, the designer inserts leafy branches such as chamadorea or fern into the base. Gladioluses are spaced so that the tips of the flowers approximate an oval or diamond shape. Carnations are placed between the gladioluses to provide contrasting form, color harmony, and depth. A bow is placed at the focal point of the spray, and foliage is added to hide construction. On the back of the sympathy card are the description 6f the spray and the donor's name and address for easy acknowledgement. The spray is ready for delivery. This type of order usually is completed in about 15 minutes.

Floral designers often have other duties. They may help customers select flowers, plants, gifts, and floral accessories available in the shop. During slack periods, designers sometimes decorate flowering plants, arrange planters and terrariums, and prepare accessories for a coming season—for example, bows and streamers for football corsages or dressings for flowering plants. The variety of duties performed by a floral designer depends on the size of the shop and the number of designers employed.

Places of Employment

About 37,000 floral designers were employed in 1976. Nearly all designers work in the retail flower

Floral arrangements express the designer's artistic talent.

shops common to large cities, suburban shopping centers, and small towns. Most shops are small and employ only one or two floral designers; many designers manage their own stores. Geographically, employment is distributed much the same as population.

Training, Other Qualifications, and Advancement

An increasing number of people now take courses in floral design to prepare for a career in this field. Courses in flower arranging are offered in many adult education programs, junior colleges, and commercial floral design schools. Longer programs provide training in flower marketing and shop management for floral designers who plan to operate their own shops. A background of formal training gives a prospective designer an advantage in obtaining a job over other applicants who have no training. However, since speed and creative ability are the most important elements in successful floral designing, training acquired on the job through actual work experience also is valuable.

Many people who want to become designers are trained on the job by the manager or an experienced floral designer. Initially they copy simple arrangements that use one type of flower. If they work quickly with their hands and recognize the shape, color and position of flowers that make attractive arrangements, instruction in more complex arrangements is given. As experience is gained, original designs required for special orders can be attempted. Usually a person can become a fully qualified floral designer after 2 years of on-the-job training.

Good color vision, manual dexterity, and the ability to arrange various shapes and colors in attractive patterns are the primary qualifications for this occupation. A high school diploma usually is desired, although not essential. Applicants must be able to write legibly and do simple arithmetic in order to write up bills for customers. High school courses in business arithmetic, bookkeeping, selling techniques, and other business subjects are helpful. Experience gained by working part time in a flower shop while still in school is very helpful.

Floral designers with supervisory ability may advance to manager or design supervisor in large flower shops. Managers who have the necessary capital may open their own shops.

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Employment Outlook

Employment of floral designers is expected to increase faster than the average for all occupations through the mid-1980's. In addition to job openings created by employment growth, many openings will arise each year as workers retire, die, or change occupations.

Floral designer employment is related to sales of retail florist shops, which vary with ups and downs in the economy. Over the long run, however, it is expected that population growth and rising income will cause sales of flowers and floral arrangements to increase significantly. As a result, more floral designers will be needed.

Earnings and Working Conditions

Limited information indicates that in 1976 experienced designers usually earned between $2.50 and $5 an hour. Inexperienced floral designers generally earned the minimum wage. Although their earnings are often low, designers achieve the additional satisfaction of doing creative work and seeing their ideas transformed into reality.

In small shops, floral designers often work 8 hours a day, Monday through Saturday. In many large shops, designers who work Saturday get a day off during the week. Designers generally work long hours around certain holidays, such as Easter and Valentine's Day, when the demand for flowers is great.

Most designers receive holiday and vacation pay. Because most shops are small, other fringe benefits are limited. Some employers pay part of the cost of group life and health insurance but few contribute to retirement plans other than social security. Floral designers in a few cities are members of the Retail Clerks International Association.

Floral designers must be able to stand for long periods. Work areas are kept cool and humid to preserve the flowers, and designers are exposed to sudden temperature changes when entering or leaving storage refrigerators. In general, however, florist shops are clean and well-ventilated, and provide a pleasant atmosphere.

Sources of Additional Information

For additional information about careers in floral design and addresses of schools offering courses in this field, write to:

Society of American Florists, 901 N. Washington St., Alexandria, Va. 22314.

INDUSTRIAL DESIGNERS

(D.O.T. 142.081)

Nature of the Work

When people buy a product, whether it's a home appliance, a new car, or a ball point pen, they want it to be as attractive, safe, and easy to use as possible. Industrial designers combine artistic talent with knowledge of marketing, materials, and methods of production to improve the appearance and functional design of products so that they compete favorably with similar goods on the market.

As the first step in their work, industrial designers compare the product with competing products, and gather information about such things as the needs of the user of the product, fashion trends, and effects of the product on its environment. After the initial research, industrial designers sketch different designs and consult with engineers, production supervisors, and sales and market research personnel about the practicability and sales appeal of each idea. Teamwork is important to get the best information about specialized areas of concern, such as engineering problems or new production or marketing methods.

After company officials select the most suitable design, the industrial designer or a professional modeler makes a model, often of clay so that it can be easily changed. After any necessary revisions, a final or working model is made, usually of the material to be used in the finished prod-

Industrial designers confer on plans for new product.

uct. The approved model then is put into production.

Although most industrial designers are product designers, many others employed by business organizations are involved in different facets of design. Some industrial designers seek to create favorable public images for companies and for government services such as transportation by developing trademarks or symbols that appear on the firm's product, advertising, brochures, and stationery. Some design containers and packages that both protect and promote their contents. Others prepare small display exhibits or the entire layout for industrial fairs. Some design the interior layout of special purpose commercial buildings such as restaurants and supermarkets.

Corporate designers employed by a manufacturing company usually work only on the products made by their employer. This may involve filling day-to-day design needs of the company or long-range planning of new products. Consultant designers who serve more than one industrial firm often plan and design a great variety of products.

Places of Employment

About 12,000 persons were employed as industrial designers in 1976. Most worked for large manufacturing companies designing either consumer or industrial products or for design consulting firms. Others did freelance work, or were on the staffs of architectural and interior design firms. A few taught industrial design in colleges, universities, and art schools.

Industrial design consultants work mainly in large cities such as New York, Chicago, Los Angeles, and San Francisco. Industrial designers with industrial firms usually work in or near the manufacturing plants of their companies, which often are located in small and medium-sized cities.

Training, Other Qualifications, and Advancement

Completing a course of study in industrial design in an art school, in the design or art department of a university, or in a technical college is the usual requirement for entering this field of work. Persons majoring in engineering, architecture, and fine arts may qualify as industrial designers if they have appropriate experience and artistic talent. Most large manufacturing firms hire only industrial designers who have a bachelor's degree in the field.

In 1976, 33 colleges and art schools offered programs in industrial design that were either accredited by the National Association of Schools of Art or recognized by the Industrial Designers Society of America.

Industrial design programs may take either 4 or 5 years, and lead to a bachelor's degree in industrial design or fine arts. Some schools require applicants to submit sketches and other examples of their artistic ability for prior approval. Some schools also award a master's degree in industrial design.

Industrial design programs differ considerably among schools. Most college and university programs maintain a balance between science, humanities, and art; art schools generally stress a strong foundation in art. In most programs, students spend much time in the lab designing objects in three dimensions. In studio courses, students make models with clay, wood, plaster, and other easily worked materials. In schools that have the necessary machinery, students make models of their designs while learning to use metalworking and woodworking machinery. Students also take courses in drawing, drafting, and other visual communications skills.

Many industrial design programs, particularly those that are part of a liberal arts college or university, also include courses in basic engineering, in the physical and natural sciences, in the behavioral sciences, and in marketing and business administration.

Industrial designers must have creative talent, drawing skills, and the ability to see familiar objects in new ways. They must understand and meet the needs and tastes of the public, rather than design only to suit their own artistic sensitivity. Designers should not be discouraged when their ideas are rejected—often designs must be resubmitted many times before one is accepted. Since industrial designers must cooperate with engineers and other staff members, the ability to work and communicate with others is important. A sound understanding of marketing, sales work, and other business practices is important for design consultants.

Applicants for jobs should assemble a "portfolio" of drawings and sketches to demonstrate their creativity and ability to communicate ideas.

New graduates of industrial design programs frequently do simple assignments for experienced designers. As they gain experience, they may become supervisors with major responsibility for the design of a product or a group of products. Those who have an established reputation and the necessary funds may start their own consulting firms.

Employment Outlook

Employment in this relatively small occupation is expected to grow more slowly than the average for all occupations. In recent years, the trend has been away from frequent redesign of household products, automobiles, and industrial equipment. However, continued emphasis on issues such as ecology and product safety should increase demand for industrial designers.

Demand for industrial designers may fluctuate over short-run periods. During economic downturns when the market for new products is dampened, the need for these workers also tends to decline.

Employment opportunities are expected to be best for college graduates with degrees in industrial design. In addition to openings resulting from growth, some employment opportunities will arise each year as designers die, retire, or transfer to other fields.

Earnings and Working Conditions

Salaries for inexperienced industrial designers with a bachelor's degree generally ranged from $9,000 to $12,000 a year in 1976, according to limited data. After several years' experience, it is possible to earn $14,000 to $18,000 a year. Salaries

of those with many years of experience averaged more than $25,000 a year in 1976, but varied according to individual talent and the size and type of firm.

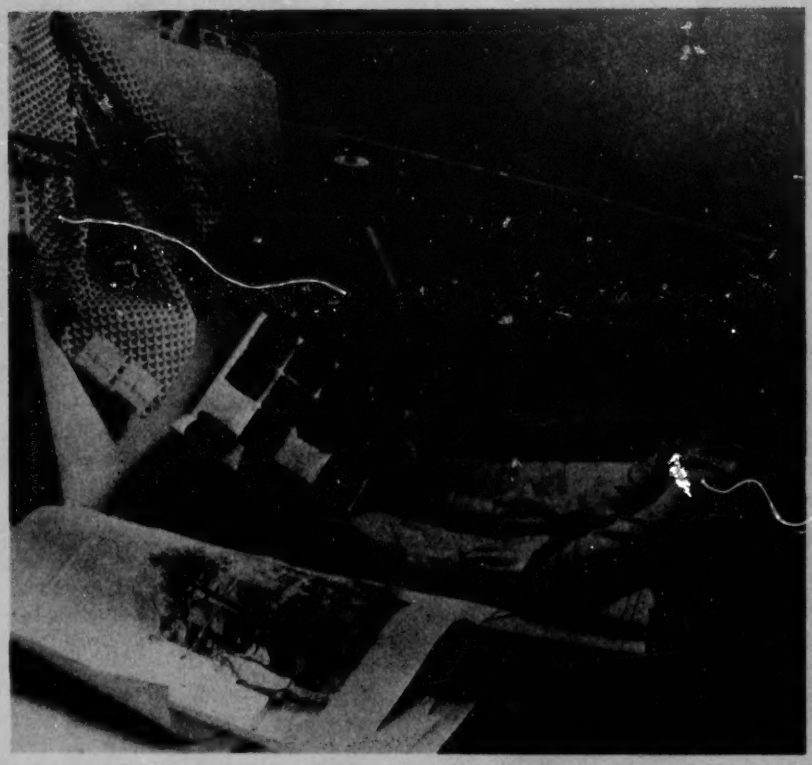
Earnings of industrial designers who own their consulting firms fluctuate greatly, but in general tend to be higher than the average earnings of corporate industrial designers.

Industrial designers generally work a 5-day, 35-40 hour week, with occasional overtime necessary to meet production deadlines. Independent consultants, who often are paid by the assignment, may work longer hours.

Sources of Additional Information

A brochure about careers and a list of schools offering courses and degrees in industrial design are available for 50 cents from:

Industrial Designers Society of America, 1750 Old Meadow Rd., McLean, Va. 22101.



A successful designer must be creative, have good color sense and good taste, and be able to work well with people.

INTERIOR DESIGNERS

(D.O.T. 142.051)

Nature of the Work

The creative work of interior designers, sometimes called *interior decorators*, helps make our living, working, and playing areas more attractive and useful. Interior designers plan and supervise the design and arrangement of building interiors and furnishings. They may work on either private homes or commercial buildings.

When planning a room, designers first consider the purpose of the area and the client's budget and taste. A very expensive couch that is easily soiled, for example, may not suit a family's needs for their recreation room.

Next, most designers prepare sketches of their plans. The sketches show all the furniture and accessories the designer is considering as well as any changes in the structure itself, such as a new wall to separate the dining and living rooms. Sometimes, the clients may not like the plans, in which case the designer must start all over again; other times, the client may want to make only minor changes, such as putting a table and chair where the designer had placed a couch.

Once the client approves both the plans and the cost, the designer may look for and then buy the furnishings, supervise the work of painters, floor finishers, carpet layers, and other craft workers if they are needed, and make sure the furnishings are installed and arranged properly.

Designers who work in large department and furniture stores that have separate design departments advise customers on decorating and design plans. Although their principal function is to help sell the store's merchandise, they sometimes may suggest furnishings from other sources when essential to the customer's plans. Department store designers also frequently advise the store's buyers and executives about style and color trends in interior furnishings.

Interior designers who specialize in nonresidential structures often work for clients on large design projects such as the interiors of entire office buildings, hospitals, and libraries. Generally they plan the complete layout of rooms without changes to the structure of the building. Sometimes, though, they redesign or renovate the interiors of old buildings. In these cases, an architect checks the plans to make sure that they comply with building requirements. Some interior designers also design the furniture and accessories to be used in various structures, and then arrange for their manufacture. A few have unusual jobs such as designing interiors of ships and aircraft or stage sets used for motion pictures or television.

All designers, regardless of where they are working, must deal with paperwork. They must place orders, figure estimates, and maintain records of where to purchase hundreds of different types of furnishings.

Places of Employment

About 37,000 persons worked as interior designers in 1976, primarily in large cities.

Some experienced interior designers manage their own establishments, either alone or as partners with other designers. Most designers work for large design firms that employ designers to work independently with their clients or as assistants to senior designers.

Other interior designers work in large department or furniture stores, and a few have permanent jobs with hotel and restaurant chains. Some work for architects, furniture suppliers, antique dealers, furniture and textile manufacturers, or other manufacturers in the interior furnishing field. Interior designers also work for magazines that feature articles on home furnishings.

Training, Other Qualifications, and Advancement

Formal training in interior design is becoming increasingly important for entry into this field. Most architectural firms, well-established design firms, department and furniture stores, and other major employers will accept only trained people for beginning jobs. The types of training available include 3-year programs in a professional school of interior design, 4-year college or university programs that grant a bachelor's degree, or postgraduate programs leading to a master's degree or Ph. D. The curriculum usually includes principles of design, history of art, freehand and mechanical drawing, painting, study of the essentials of architecture as they relate to interiors, design of furniture and exhibitions, and study of various materials, such as wood, plastics, metals, and fabrics. A knowledge of furnishings, art pieces, and antiques is important. In addition, courses in sales and business subjects are valuable.

Membership in the American Society of Interior Design is a recognized mark of achievement in this profession. Membership usually requires the completion of 3 or 4 years of post-high school education in design, and several years of practical experience in the field, including supervisory work.

Persons starting in interior design usually serve a training period with a design firm, department store, or furniture store. They may act as receptionists, as shoppers with the task of matching materials or finding accessories, or as stockroom assistants, salespersons, assistant decorators, or junior designers. In most instances, from 1 to 5 years of on-the-job training are required before a trainee becomes eligible for advancement to designer. Beginners who do not get trainee jobs often sell fabric, lamps, or other interior furnishings in department or furniture stores to gain experience in dealing with customers and to become familiar with the merchandise. There is no guarantee, however, that this experience will result in a job in design, although it could lead to a career in merchandising.

After considerable experience, designers may advance to design department head or to other supervisory positions in department stores or in large design firms. If they have the necessary funds, they may open their own businesses.

A successful designer must be creative, have good color sense and good taste, and be able to work well with people. At times, designers' tastes may not match those of their clients, so designers must be willing to make changes in plans they consider attractive and functional.

Employment Outlook

Persons seeking beginning jobs in interior design are expected to face competition through the mid-1980's. Interior design is a competitive field that requires talent, training, and business ability, and many applicants vie for the better jobs. Talented college graduates who major in interior design and graduates of professional schools of interior design will find the best opportunities for employment. Those with less talent or without formal training will find it increasingly difficult to enter this field.

Employment of interior designers is expected to increase about as fast as the average for all occupations through the mid-1980's. Growth in population, personal incomes, expenditures for home and office furnishings, and the increasing use of design services in both homes and commercial establishments should contribute to a greater demand for these workers. In addition to new jobs, some openings will be created by the need to replace designers who die, retire, or leave the field.

Department and furniture stores are expected to employ an increasing number of designers as their share in the growing volume of design work for commercial establishments and public buildings increases. Interior design firms also are expected to continue to expand.

Employment of interior designers, however, is sensitive to changes in general economic conditions because people often forego design services when the economy slows down.

Earnings and Working Conditions

Beginners usually are paid a straight salary plus a small commission. Starting salaries can range from the minimum wage plus a small commission to a fixed salary of $140 a week or higher. Firms in large metropolitan areas usually pay the highest salaries.

Some experienced interior designers are paid straight salaries, some receive salaries plus commissions based on the value of their sales, while others work entirely on commissions.

Incomes of experienced designers vary greatly. Many persons earn from $6,000 to $12,000 a year, and highly successful designers can earn much more. A small number of nationally recognized professionals earn well over $50,000 annually.

The earnings of self-employed designers vary widely, depending on the volume of business, their professional reputation, the economic level of their clients, and their own business competence.

Designers' work hours are sometimes long and irregular. Designers usually adjust their workday to suit the needs of their clients, meeting with them during the evenings or on weekends when necessary.

Sources of Additional Information

For information about careers in interior design and a list of schools offering programs in this field, contact:

American Society of Interior Design, 730 Fifth Ave., New York, N.Y. 10019.

LANDSCAPE ARCHITECTS

(D.O.T. 019.081)

Nature of the Work

Everyone enjoys attractively designed residential areas, public parks, and commercial zones. Landscape architects design these areas to satisfy functional needs as well as people's aesthetic sense.

Landscape architects assist many types of organizations in planning and designing a project, from a real estate firm starting a new suburban development to a city constructing an airport or park. They may plan and arrange trees, shrubbery, walkways, open spaces, and other features as well as supervise the necessary grading, construction, and planting.

Landscape architects first consider the nature and purpose of the project, the funds available, and the proposed buildings in planning a site. Next, they study the site and map features such as the slope of the land and the position of existing buildings, roads, walkways, and trees. They also observe the sunny parts of the site at different times of the day, soil texture, existing utilities, and many other landscape features. Then, after consulting with the project architect or engineer, they draw up plans to develop the site. If the plans are approved, landscape architects prepare working drawings showing all existing and proposed features. Landscape architects outline in detail the methods of constructing features and draw up lists of building materials. They then may invite landscape contractors to bid for the work.

Although landscape architects help design and supervise a wide variety of projects, some specialize in certain types of projects such as parks and playgrounds, hotels and resorts, shopping centers, or public housing. Still others specialize in services such as regional planning and resource management, feasibility and cost studies, or site construction.

Persons planning careers in landscape architecture should be interested in art and nature.

Places of Employment

About 13,000 persons worked as landscape architects in 1976. Most were self-employed or worked for architectural, landscape architectural, or engineering firms. Government agencies concerned with forest management, water storage, public housing, city planning, urban renewal, highways, parks, and recreation also employed many landscape architects. The Federal Government employed over 550 landscape architects, mainly in the Departments of Agriculture, Defense, and Interior. Some landscape architects were employed by landscape contractors, and a few taught in colleges and universities.

Employment of landscape architects is concentrated around large metropolitan areas, primarily on the East and West Coasts. However, employment opportunities have recently been growing in the Southwest.

Training, Other Qualifications, and Advancement

A bachelor's degree in landscape architecture which takes 4 or 5 years is usually the minimum educational requirement for entering the profession. The American Society of Landscape Architects accredits about 40 colleges and universities that offer such programs. About 60 other schools also offer programs or courses in landscape architecture.

A person interested in landscape architecture should take high school courses in mechanical or geometrical drawing, art, botany, and more mathematics than the minimum required for college entrance. A good background in English grammar also is important, since landscape architects must be able to express their ideas verbally as well as graphically.

College courses include technical subjects such as surveying, landscape construction, sketching, design communications, and city planning. Other courses include horticulture and botany as well as English, science, and mathematics. Most college programs also include field trips to view and study examples of landscape architecture.

Thirty-eight States require a license, based on the results of a uniform national licensing examination, for independent practice of landscape architecture. Admission to the licensing examination usually requires a degree from an accredited school of landscape architecture plus 2 to 4 years of experience. Lengthy apprenticeship training (6-8 years) under an experienced landscape architect sometimes may be substituted for college training.

Persons planning careers in landscape architecture should have creative imagination, drawing talent, and an appreciation for nature. Self-employed landscape architects also must understand business practices. Working for landscape architects or landscape contractors during summer vacations helps a person understand the practical problems of the profession, and may be helpful in obtaining employment after graduation.

New graduates usually begin as junior drafters, tracing drawings and doing other simple drafting work. After gaining experience, they help prepare specifications and construction details and handle other aspects of project design. After 2 or 3 years they can usually carry a design through all stages of development. Highly qualified landscape architects may become associates in private firms; landscape architects who progress this far, however, often open their own office.

Employment Outlook

Employment of landscape architects is expected to grow faster than the average for all occupations through the mid-1980's. Additionally, new entrants will be needed as replacements for landscape architects who retire or die.

Anticipated rapid growth in new construction is expected to play a major role in increasing demand for landscape architects. However, during slow periods the demand could be limited.

Another factor underlying the increased demand for landscape architects is the growing interest in city and regional environmental planning. Metropolitan areas will require landscape architects to plan efficient and safe land use for growing populations. Legislation to promote environmental protection could also spur demand for landscape architects to participate in planning and designing transportation systems, outdoor recreation areas, and land reclamation projects, as well as to ensure safe industrial growth.

Earnings and Working Conditions

Newly graduated landscape architects generally earned from $10,500 to $12,500 a year in 1976. Most experienced landscape architects earned between $15,000 and $20,000 a year, although some highly skilled persons earned salaries of over $30,000 a year. Salaries of self-employed landscape architects ranged from $10,000 a year to well over $25,000 a year, depending on the individual's educational background, experience, and geographic location.

The Federal Government, in 1977, paid new graduates with a bachelor's degree annual salaries of $9,300 or $11,500 depending on their qualifications. Those with an advanced degree had a starting salary of $14,100 a year. Landscape architects in the Federal Government averaged $22,500 a year.

Salaried employees both in government and in landscape architectural firms usually work regular hours, although employees in private firms may also work overtime during seasonal rush periods or to meet a deadline. Self-employed persons often work long hours.

Sources of Additional Information

Additional information, including a list of colleges and universities offering accredited courses of study in landscape architecture, is available from:

American Society of Landscape Architecture, Inc., 1750 Old Meadow Rd., McLean, Va. 22101.

For information on a career as a landscape architect in the Forest Service, write to:

U.S. Department of Agriculture, Forest Service, Washington, D.C. 20250.

PHOTOGRAPHERS

(D.O.T. 143.062, .282, and .382)

Nature of the Work

Photographers use their cameras and film to portray people, places, and events much as a writer uses words. Those who are skillful can capture the personality of individuals or the mood of scenes which they photograph. Some photographers specialize in scientific, medical, or engineering photography, and their pictures enable thousands of persons to see a world normally hidden from view.

Although their subject matter varies widely, all photographers use the same basic equipment. The most important piece, of course, is the camera, and most photographers own several. Unlike snapshot cameras, which have a lens permanently attached to the camera body, professional cameras are constructed to use

Commercial photographers must be imaginative and original.

a variety of lenses designed for close-up, medium-range, or distance photography.

Besides cameras and lenses, photographers use a variety of film and colored filters to obtain the desired effect under different lighting conditions. When taking pictures indoors or after dark, they use electronic flash units, floodlights, reflectors, and other special lighting equipment.

Some photographers develop and print their own photographs in the darkroom and may enlarge or otherwise alter the basic image. Many photographers send their work to photographic laboratories for processing.

Because the procedures involved in still photography are quite different from those in motion picture photography, many photographers specialize in one or the other. However, there is a growing demand for photographers who have training in both areas.

In addition to knowing how to use their equipment and materials, photographers must be capable of composing the subjects of their photographs and recognizing a potentially good photograph.

Many photographers specialize in a particular type of photography, such as portrait, commercial, or industrial work. Portrait photographers take pictures of individuals or groups of persons and often work in their own studios. For special events, such as weddings or christenings, however, they take photographs in churches and homes. Portrait photographers in small studios frequently do all the operations, including scheduling appointments and setting up and adjusting equipment before taking the pictures, as well as developing and retouching negatives, developing proofs, and mounting and framing pictures. They also may be the ones to collect payments and keep records, and therefore must be good business persons.

Commercial photographers photograph a wide range of subjects including livestock, manufactured articles, buildings, and large groups of people. They frequently do photography for catalogs. Those in advertising take pictures to promote such items as clothing, furniture, automobiles, and food, and may specialize in one such area. Advertising photographers must know how to use many different photographic techniques.

The work of industrial photographers is used in company publications to report to stockholders or to advertise company products or services. Industrial photographers also photograph groups of people for employee news magazines or may take motion pictures of workers operating equipment and machinery for management's use in analyzing production or work methods. They may also use special photographic techniques as research tools. For example, medical researchers often use ultraviolet and infrared photography, fluorescence, and X-rays to obtain information not visible under normal conditions. Time lapse photography (where time is stretched or condensed), photomicrography (where the subject of the photography may be magnified 50 or 70 times or more), and photogrammetry (surveying an area using aerial photography) are other special techniques.

Other photographic specialties include photojournalism, or press photography, which combines a "nose for news" with photographic ability; and educational photography (preparing slides, filmstrips, and movies for use in the classroom).

Places of Employment

About 85,000 photographers were employed in 1976. The greatest proportion worked in commercial studios; many others worked for newspapers and magazines. Government agencies, photographic equipment suppliers and dealers, and industrial firms also employed large numbers of photographers. In addition, some photographers taught in colleges and universities, or made films. Still others worked freelance, taking pictures to sell to advertisers, magazines, and other customers. About one-third of all photographers were self-employed.

Jobs for photographers are found in all parts of the country—both small towns and large cities—but are concentrated in the more populated areas.

Training, Other Qualifications, and Advancement

Photographic training is available in colleges, universities, junior colleges, and art schools. Over 75 colleges and universities offer 4-year curriculums leading to a bachelor's degree in photography. Some colleges and universities grant master's degrees in specialized areas, such as photojournalism. In addition, some colleges have 2-year curriculums leading to a certificate or an associate degree in photography. A formal education in photography gives a solid fundamental background in a variety of equipment, processes, and techniques. Art schools offer useful training in design and composition, but not the technical training needed for professional photographic work. (See the statement on commercial artists elsewhere in the *Handbook*.) The Armed Forces also train many young people in photographic skills.

Although a high school education is desirable, the photography profession has no set entry requirements with regard to formal education or training. However, the training a prospective photographer has determines the type of work for which he or she qualifies.

People may prepare for work as photographers in a commercial studio through 2 or 3 years of on-the-job training as a photographer's assistant. Trainees generally start in the darkroom where they learn to mix chemicals, develop film, and do photoprinting and enlarging. Later

they may set up lights and cameras or help an experienced photographer take pictures.

Amateur experience is helpful in getting an entry job with a commercial studio, but post-high school education and training usually are needed for industrial or scientific photography. Here success in photography depends on being more than just a competent photographer, and adequate career preparation requires some knowledge of the field in which the photography is used. For example, work in scientific, medical, and engineering research, such as photographing microscopic organisms, requires a background in the particular science or engineering specialty as well as skill in photography.

Photographers must have good eyesight and color vision, artistic ability, and manual dexterity. They also should be patient and accurate and enjoy working with detail. Some knowledge of mathematics, physics, and chemistry is helpful for understanding the use of various lenses, films, light sources, and development processes.

Some photographic specialties require additional qualities. Commercial or freelance photographers must be imaginative and original in their thinking. Those who specialize in photographing news stories must be able to recognize a potentially good photograph and act quickly, for otherwise an opportunity to capture an important event on film may be lost. Photographers who specialize in portrait photography need the ability to help people relax in front of the camera.

Newly hired photographers are given relatively routine assignments that do not require split-second camera adjustments or decisions on what subject matter to photograph. News photographers, for example, may be assigned to cover civic meetings or photograph snow storms. After gaining experience they advance to more demanding assignments, and some may move to staff positions on national news magazines. Photographers with exceptional ability may gain national recognition for their work and exhibit their photographs in art and photographic galleries, or publish them in books. A few industrial or scientific photographers may be promoted to supervisory positions. Magazine and news photographers may eventually become heads of graphic arts departments or photography editors.

Employment Outlook

Employment of photographers is expected to grow more slowly than the average for all occupations through the mid-1980's. In addition to openings resulting from growth, others will occur each year as workers die, retire, or transfer to other occupations.

Growth of employment in business and industry is occurring as greater importance is placed upon visual aids for use in meetings, stockholders' reports, sales campaigns, and public relations work. Video and motion picture photography are becoming increasingly important in industry. Photography also is becoming an increasingly important part of law enforcement work, as well as scientific and medical research, where opportunities are expected to be good for those possessing a highly specialized background.

The employment of portrait and commerical photographers is expected to grow slowly, and competition for jobs as portrait and commercial photographers and photographers' assistants is expected to be keen. These fields are relatively crowded since photographers can go into business for themselves with a modest financial investment, or work part time while holding another job. The increased use of self-processing cameras in commercial photography also has contributed to the crowding in this field, since little photographic training is required for such work.

Earnings and Working Conditions

Beginning photographers who worked for newspapers that have contracts with The Newspaper Guild had weekly earnings between $128 and $432 in 1976, with the majority earning between $175 and $225. Newspaper photographers with some experience (usually 4 or 5 years) averaged about $320 a week in 1976. Almost all experienced newspaper photographers earned over $225; the top salary was nearly $505 a week.

Photographers in the Federal Government earned an average of $14,900 a year in 1976. Depending on their level of experience, newly hired photographers in the Federal Government earned from $8,320 to $11,520 a year. Most experienced photographers earned between $11,520 and about $18,460 a year.

Experienced photographers generally earn salaries that are above the average for nonsupervisory workers in private industry, except farming. Although self-employed and freelance photographers often earn more than salaried workers, their earnings are affected greatly by general business conditons and the type and size of their community and clientele.

Photographers who have salaried jobs usually work a 5-day, 35-40 hour week and receive benefits such as paid holidays, vacations, and sick leave. Those in business for themselves usually work longer hours. Freelance, press, and commercial photographers travel frequently and may have to work in uncomfortable surroundings. Sometimes the work can be dangerous, especially for news photographers assigned to cover stories on natural disasters or military conflicts.

Sources of Additional Information

Career information on photography is available from:

Photographic Art & Science Foundation, 111 Stratford Rd., Des Plaines, Ill. 60016.

Professional Photographers of America, Inc. 1090 Executive Way, Des Plaines, Ill. 60018.

COMMUNICATIONS-RELATED OCCUPATIONS

The art of communications is as old as humanity. From the earliest discoveries of papermaking techniques to today's use of computers that transmit information with hitherto unimagined speed, people have sought ways of recording the events around them and conveying the information to others. Communication is a process that begins with observing what is happening, analyzing and interpreting that information, and transmitting it to an audience through a variety of media, of which radio, television, newspapers, magazines, and books are the most familiar.

The communications field includes a broad range of occupations having to do with research, writing, editing, and production; it also encompasses public relations, advertising, and other specialties. The following section of the *Handbook* describes four of these occupations—interpreters, newspaper reporters, radio and television announcers, and technical writers. Other communications jobs are described elsewhere in the *Handbook*, in the statements on occupations in radio and TV broadcasting; occupations in the printing and publishing industry; advertising workers; public relations workers; photographers; and commercial artists.

The four occupations described below all require a broad education, with preparation either in the liberal arts and humanities or in a scientific or technical field, depending on specific career interest. The intellectual habits acquired during college are important. Acute powers of observation and the ability to think clearly and logically are necessary traits, because people in these jobs need to understand the significance of the events they observe. An excellent command of language—both written and oral—is essential. It is through appropriate choice of words or phrases that interpreters and technical writers, for example, put foreign or complex matter into language that is readily understood. A feeling for language enables newspaper reporters and broadcast journalists to breathe life and meaning into the overwhelming number of events that occur every day.

In addition to a broad education and outstanding language skills, people in communications jobs need to be very well informed about certain subjects. Depending on the job, they may need to be versed in economics, law, politics, science, education, music, or sports. They may be called upon to explain legal issues discussed by experts at an international conference on the law of the sea; national economic and political events for readers of a smalltown newspaper; the latest developments in data communications technology for readers of a trade journal; or the history of jazz, classical, bluegrass, or other music featured on a radio show.

Competition for most communications jobs is keen, for the field traditionally attracts many more jobseekers than there are job openings. Some people are attracted by the "glamorous" image of media jobs—the opportunities to meet public figures, to appear before nationwide audiences, to attend special events. Attending social functions is only part of a journalist's job, however; many hours a day may be spent on the tedious but essential tasks of making contacts, checking facts, and following leads.

Despite the keen competition, jobs will be available through the mid-1980's for bright and talented people. For some, willingness to take a job where one is available—in a small town instead of Los Angeles or New York City—and willingness to "start at the bottom" may make the difference between success and failure in breaking into the communications field.

INTERPRETERS

(D.O.T. 137.268)

Nature of the Work

Interpreters help people of different nations and different cultures overcome language barriers by translating what has been said by one person into a language that can be understood by others.

There are two basic types of oral translation or interpretation: simultaneous and consecutive. In simultaneous interpretation, the interpreter translates what is being said in one language as the speaker continues to talk in another. This technique requires speed and fluency in the foreign language on the part of the interpreter and it is made possible by the use of electronic equipment, which allows for the transmission of the simultaneous speeches. Conference interpreters often work in a glass-enclosed booth from which they can see the speaker. While listening through earphones to what is being said, they simultaneously give the translation by speaking into a microphone. People attending the conference who do not understand the language being spoken may listen to an interpreter's rendition by simply pushing a button or turning a dial to get the translation in the language they know. Simultaneous interpretation generally is preferred for conferences, and the development of portable equipment has extended its use to other large-scale situations.

Consecutive interpretation also involves oral translation. However, the speaker and the interpreter take turns speaking. A consecutive interpreter must have a good memory and generally needs to take notes in order to give a complete and exact translation. The chief drawback of consecutive interpretation is that the process is time consuming, because the speaker must wait for the translation before proceeding.

Since interpreters are needed whenever people find language a barrier, the work involves a variety of

topics and situations. Interpreters may be needed, for example, to explain various aspects of American life to a group of foreign visitors, or they may be required to interpret highly technical speeches and discussions for medical or scientific gatherings. They may work at the United Nations, or find themselves in a courtroom or escorting foreign leaders or business people visiting the United States.

Places of Employment

An estimated 175 persons worked full time as interpreters in the United States in 1976. The largest single concentration of interpreters was at the United Nations in New York where about 90 people held full-time posts. Various other international organizations, located primarily in Washington, D.C., also employed regular staff interpreters. Among these are the Organization of American States, the International Monetary Fund, the Pan American Health Organization, and the World Bank. Within the Federal Government, the Departments of State and Justice were the major employers of full-time interpreters.

An estimated 500 persons worked as freelance interpreters. Freelance interpreters may work for various employers under short-term contracts. About four-fifths were under contract on a temporary basis to the Department of State and the Agency for International Development to serve as escort interpreters for foreign visitors to the United States. Some of these interpreters worked a great portion of the year; others worked for only a few days. The remainder of the freelance interpreters worked in the freelance conference field. These interpreters provided for both the supplementary needs of the international and Federal agencies and for the periodic, short-term needs of various international conferences that are held in this country. The Organization of American States employs many people in this area. Besides persons who work strictly as interpreters, many others do some interpretation work in the course of their jobs.

Interpreters must instantaneously call to mind words or idioms corresponding to foreign ones.

Training, Other Qualifications, and Advancement

A complete command of two languages or more is the usual requirement for becoming an interpreter. Interpreters must instantaneously call to mind words or idioms corresponding to the foreign ones. An extensive working vocabulary and ease in making the transition from one language structure to another are necessary.

Students who want to become interpreters should become fluent in several languages. Interpreters who work at the United Nations, for example, must know at least three of the six official U.N. languages: Arabic, Chinese, English, French, Russian, and Spanish. Portuguese and, to some extent, Japanese and German are also valuable to interpreters in the United States.

Two schools in the United States offer special programs for interpreter training. Both require foreign language proficiency upon entry. The Georgetown University School of Languages and Linguistics in Washington, D.C., has a 1- or 2-year course of study leading to a Certificate of Proficiency as a conference interpreter. The certificate is recognized by the International Association of Conference Interpreters. Applicants to Georgetown University must qualify on the basis of an entrance test and a minimum of previous studies at the university level; successful candidates usually hold a bachelor's degree, often a master's degree. The Monterey Institute of Foreign Studies in Monterey, Calif., through its Department of Translation and Interpretation, offers a 2-year graduate program leading to a master's degree in Intercultural Communication and a graduate certificate in either translation, translation/interpretation, or in conference interpretation. Applications to the Institute must have a bachelor's degree and pass an aptitude test. They must be fluent in English, plus one other language if studying translation, or in two other languages if wishing to enter the interpretation field. After taking the basic courses in translation and interpretation theory, students must pass a qualifying examination in order to enter the translation or interpretation program. This qualifying examination usually takes place after two semesters of work at the Institute.

Many individuals may qualify as interpreters on the basis of their foreign backgrounds for positions in which extensive experience and a broad education are not as crucial as for other types of interpretation. For example, consecutive interpreters employed by the Immigration and Naturalization Service of the U.S. Department of Justice serve primarily in interpreting legal proceedings, such as hearings for aliens.

Besides being proficient in languages, interpreters are expected to be generally well informed on a broad range of subjects, often including technical subjects such as medicine or scientific or industrial technology. Work as a translator may serve as a useful background in maintaining an up-to-date vocabulary in various specialized or technical areas. The experience of living abroad also is very important for an interpreter.

Although there is no standard requirement for entry into the profession, a university education usually is considered essential.

People interested in becoming interpreters should be articulate speakers and have good hearing. The exacting nature of this profession requires quickness, alertness, and a constant attention to accuracy. Working with all types of people requires good sense, tact, and the emo-

tional stamina to deal with the tensions of the job. It is essential that interpreters maintain confidentiality in their work and that they give honest interpretations.

Advancement in the interpreting field generally is based on satisfactory service. There is some advancement from escort level interpreting to conference level work.

Employment Outlook

Interpreters traditionally face very stiff competition for the limited number of openings. Little change is expected in the number of full-time interpreters through the mid-1980's. Most opportunities, therefore, should result from the need to replace workers who die, retire, or leave their jobs for other reasons. Experience has shown that any slight or sporadic increase in the demand for interpreters can be met by the existing pool of freelance workers. Only highly qualified applicants will find jobs.

Qualified interpreters also may find work abroad. The demand for interpreters in Europe, where so many different languages are spoken, is far greater than in the United States.

People who have linguistic abilities also may find some employment opportunities as translators. In fact, many interpreters find the ability to do translation work, if not requisite, an occupational asset. Foreign language competence also is important for careers in the fields of foreign service, international business, and language education.

Earnings and Working Conditions

Salaries of interpreters depend upon the type of interpreting done as well as the ability and performance of the individual. The tax-free annual starting salary for conference interpreters at the United Nations was $14,300 in 1976. Outstanding U.N. interpreters could expect to earn almost $30,000.

Beginning salaries for interpreters in various other international organizations were over $15,000 a year, according to the limited information available. In addition, international organizations often paid supplementary living and family allowances.

Junior interpreters who worked for the U.S. Department of State received $17,056 a year in 1977. Starting salaries were somewhat lower for interpreters in other Federal agencies.

In the freelance field, interpreters are paid on a daily basis. Conference interpreter salaries ranged from about $125 to $160 a day in 1976. The U.S. Department of State paid a daily salary of $125.

Freelance escort interpreters received salaries ranging from about $40 to over $80 a day, based on the individual's skill and prior performance. Interpreters on assignment usually could expect to be paid for a 7-day week. Interpreters are paid transportation expenses by the employing agency and also receive an allowance to cover the cost of accommodations, meals, and other expenses incidental to their assignments.

The conditions under which interpreters work vary widely. In freelancing, there is little job security because of demand fluctuations, and the duration of various freelance assignments ranges from a few days for a typical conference to several weeks for some escort assignments. Although the hours interpreters work are not necessarily long, they are often irregular. In some instances, especially for escort freelance workers, a great deal of travel to a wide variety of locations is required.

Sources of Additional Information

Information on the interpreting profession is available from:

The American Association of Language Specialists, 1000 Connecticut Ave. NW., Suite 9, Washington, D.C. 20036.

For information on entry requirements and courses of study at the two schools offering specialized programs for interpreters, contact:

Division of Interpretation and Translation, School of Languages and Linguistics, Georgetown University, Washington, D.C. 20057.

Department of Translation and Interpretation, Monterey Institute of Foreign Studies, P.O. Box 1978, Monterey, Calif. 93940.

Information about employment opportunities is available from:

Language Services Division, U.S. Department of State, Washington, D.C. 20520.

Secretariat Recruitment Service, United Nations, New York, N.Y. 10017.

NEWSPAPER REPORTERS

(D.O.T. 132.268)

Nature of the Work

Newspaper reporters gather information on current events and use it to write stories for publication in daily or weekly newspapers. In covering events, they may interview people, review public records, attend news events, and do research. As a rule, reporters take notes or use tape recorders while collecting facts, and write their stories upon return to the office. Sometimes, to meet deadlines, they telephone their information or stories to rewriters who write or transcribe the stories for them.

Large dailies frequently assign some reporters to "beats," such as police stations or the courts, to gather news originating in these places. General assignment reporters handle various types of local news, such as a story about a lost child or an obituary of a community leader. Specialized reporters with a background in a particular subject interpret and analyze the news in fields such as medicine, politics, science, education, business, labor, and religion.

Reporters on small newspapers may cover not only all aspects of local news, but also may take photographs, write headlines, lay out pages, and write editorials. On some small weeklies, they also may solicit advertisements, sell subscriptions, and perform general office work.

Places of Employment

More than 40,000 persons worked as newspaper reporters in 1976. The majority of reporters work for urban daily newspapers; others work for suburban, community, or small town weekly papers and press services.

Reporters work in cities and towns of all sizes. Of the 1,762 daily and 7,579 weekly newspapers, the great majority are in medium-sized towns.

Reporters gathering news information.

However, most reporters work in cities, since big city dailies employ many reporters, whereas a small town paper generally employs only a few.

Training, Other Qualifications, and Advancement

Most newspapers consider only applicants who have a college education. Graduate work is increasingly important. Many editors prefer graduates who have a degree in journalism, which usually includes training in the liberal arts along with professional journalism training. Some editors consider a liberal arts degree sufficient. Others prefer applicants who have a liberal arts bachelor's degree and a master's degree in journalism. High school courses that are useful include English, journalism, social science, and typing.

Bachelor's degree programs in journalism are available in almost 250 colleges. About three-fourths of the courses in a typical undergraduate journalism curriculum are in liberal arts. Journalism courses include reporting, copyreading, editing, feature writing, history of journalism, law, and the relation of the press to society.

More than 500 junior colleges offer journalism programs. Twelve to fifteen hours of credit earned is transferable to most 4-year college programs in journalism. A few junior colleges also offer programs especially designed to prepare the student directly for employment as a general assignment reporter on a weekly or small daily newspaper. The Armed Forces also provide some training in journalism.

A master's degree in journalism was offered by more than 90 schools in 1976; about 20 schools offered the Ph. D. degree. Some graduate programs are intended primarily as preparation for news careers, while others concentrate on preparing journalism teachers, researchers and theorists, and advertising and public relations workers.

Persons who wish to prepare for newspaper work through a liberal arts curriculum should take English courses that include writing, as well as subjects such as sociology, political science, economics, history, psychology, computer science, and speech. Ability to read and speak a foreign language is desirable. Those who look forward to becoming reporters in a specialized field such as science should concentrate on course work in their subject matter areas. Skill in typing is essential because reporters type their own news stories. On small papers, knowledge of news photography also is valuable.

The Newspaper Fund and individual newspapers offer summer internships that provide college students with an opportunity to practice the rudiments of reporting or editing. In addition, more than 2,700 journalism scholarships, fellowships, and assistantships were awarded to college journalism students by universities, newspapers, and professional organizations in 1976.

News reporting involves a great deal of responsibility, since what a reporter writes frequently influences the opinion of the reading public. Reporters should be dedicated to serving the public's need for accurate and impartial news. Although reporters work as part of a team, they have an opportunity for self-expression. Important personal characteristics include a "nose for news," curiosity, persistence, initiative, resourcefulness, an accurate memory, and the physical stamina necessary for an active and often fast-paced life.

Some who compete for full-time reporter jobs find it is helpful to have

had experience as a newspaper "stringer"—a part-time reporter who covers the news in a particular area of the community and is paid on the basis of the stories printed. High school and college newspapers, and church or community newsletters, also provide writing and editing experience that may be helpful in getting a job.

Most beginners start on weekly or on small daily newspapers as general assignment reporters or copy editors. A few outstanding journalism graduates are hired by large city papers, but this is the exception rather than the rule. Large dailies generally require several years of reporting experience, which usually is acquired on smaller newspapers.

Beginning reporters are assigned duties such as reporting on civic and club meetings, summarizing speeches, writing obituaries, interviewing important visitors to the community, and covering police court proceedings. As they gain experience, they may report more important events, cover an assigned "beat," or specialize in a particular field.

Newspaper reporters may advance to reporting for larger papers or press services. Some experienced reporters become columnists, correspondents, editorial writers, editors, or top executives; these positions represent the top of the field and competition for them is keen. Other reporters transfer to related fields such as public relations, writing for magazines, or preparing copy for radio and television news programs.

Employment Outlook

Competition for newspaper reporting jobs is expected to continue through the mid-1980's. If enrollments continue at record levels as they have in the past few years, record numbers of journalism graduates will be looking for jobs. However, employment in the communications field is not expected to expand sufficiently to absorb all those seeking jobs, and a sizable number of journalism graduates will have to launch careers in other fields.

Newspaper reporters in particular face heightened job competition. Although the communications field is expected to expand through the mid-1980's, newspapers are not expected to share fully in this growth. As a result, employment of reporters will increase more slowly than the average for all occupations. Most job openings will arise from the need to replace reporters who are promoted to editorial or administrative positions, transfer to other fields of work, retire, or leave the profession for other reasons.

Bright, energetic persons with exceptional writing ability will have the best opportunities for beginning jobs as newspaper reporters. Talented writers who are able to handle news about highly specialized scientific or technical subjects will also be at an advantage in the competitive job market.

Weekly or daily newspapers located in small towns and suburban areas are expected to continue to offer most of the opportunities for beginners entering newspaper reporting. Openings arise on these papers as reporters gain experience and move up to other editorial positions or transfer to reporting jobs on larger newspapers or to other types of work. Beginning reporters able to help with photography and other specialized aspects of newspaper work and who are acquainted with the community are likely to be given preference in employment on small papers.

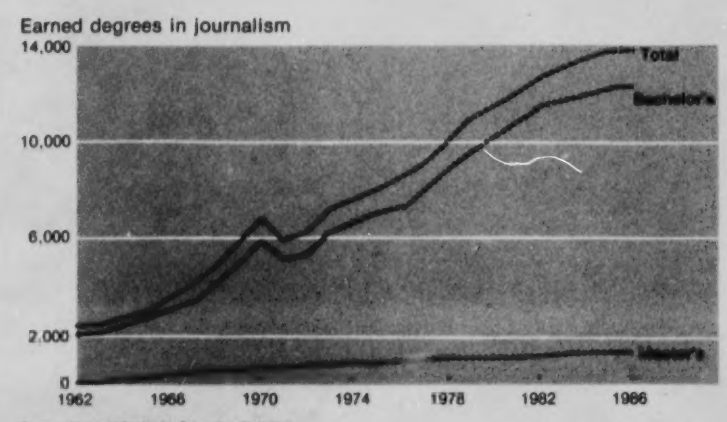
Most big city dailies require experience and do not ordinarily hire new graduates. Sometimes, however, new graduates find newsroom jobs on major metropolitan dailies because of outstanding credentials in an area for which a particular paper has a pressing need. Occasionally, the experience and contacts gained through an internship program lead to a reporting job directly after graduation.

In addition to newspaper reporting, college graduates who have majored in journalism have the background for jobs in related fields such as advertising, public relations, trade and technical publishing, radio and television, and law. Because continued high enrollment is foreseen in journalism education programs, opportunities to teach journalism are expected to be good. College teaching jobs currently require professional experience and at least a master's degree.

Earnings and Working Conditions

Reporters working for daily newspapers having contracts negotiated by The Newspaper Guild had average starting salaries of $10,600 in late 1976. In general, earnings of newspaper reporters in 1976 were above average earnings received by nonsupervisory workers in private industry, except farming.

Rapid increase in the number of journalism graduates will produce intense competition for communications jobs



Source: National Center for Education Statistics

Minimum salaries of reporters having 4 or 5 years of experience who worked for daily newspapers with Guild contracts averaged $16,700 in 1976. The minimums ranged from $9,960, paid by the smallest dailies, to more than $26,000 paid by the largest. Many reporters, however, were paid salaries higher than these minimums. Reporters working for national wire services received annual salaries of at least $19,000.

Most newspaper reporters generally work a 5-day, 35- or 40-hour week. Reporters working for morning papers usually start work in the late afternoon and finish at about midnight. Most reporters also receive benefits such as paid vacations, group insurance, and pension plans.

Sources of Additional Information

Information about opportunities for reporters with daily newspapers is available from:

American Newspaper Publishers Association Foundation, P.O. Box 17407, Dulles International Airport, Washington, D.C. 20041.

For information on opportunities in the newspaper field and starting salaries of journalism graduates, as well as a list of journalism scholarships, fellowships, assistantships, and loans available at colleges and universities, write to:

The Newspaper Fund, Inc., Box 300, Princeton, N.J. 08540.

Information on union wage rates is available from:

The Newspaper Guild, Research and Information Department, 1125 15th St. NW., Washington, D.C. 20005.

For general information about careers in journalism contact:

American Council on Education for Journalism, School of Journalism, University of Missouri, Columbia, Mo. 65201.

Association For Education in Journalism, 102 Reavis Hall, Northern Illinois University, Dekalb, Ill. 60115.

The Society of Professional Journalists, Sigma Delta Chi, 35 East Wacker Dr., Chicago, Ill. 60601.

Information on opportunities for women in newspaper reporting and other communications fields is available from:

Women In Communications, Inc., P.O. Box 9561, Austin, Tex. 78766.

Names and locations of daily newspapers and a list of schools and departments of journalism are published in the *Editor and Publisher International Year Book*, available in most public libraries and large newspaper offices.

RADIO AND TELEVISION ANNOUNCERS

(D.O.T 159.148)

Nature of the Work

Most radio announcers act as disc jockeys, introducing recorded music, presenting news and commercials, and commenting on other matters of interest to the audience. They may "ad-lib" much of the commentary, working without a detailed script. They also may operate the control board, sell time for commercials, and write commercial and news copy. In large stations, however, other workers handle these jobs. (See the statement on occupations in the radio and television broadcasting industry elsewhere in the *Handbook*.)

Announcers employed by television stations and large radio stations usually specialize in particular kinds of announcing such as sports, news, or weather. They must be thoroughly familiar with their particular area. If a written script is needed for parts of the program, the announcer may do the research and writing. Announcers frequently participate in community activities. A sportscaster, for example, might be the master of ceremonies at a touchdown club banquet or greet customers at the opening of a new sporting goods store. Some announcers become well-known and highly paid personalities.

Places of Employment

About 26,000 announcers were employed by radio and television broadcasting stations in 1976. The average commercial radio or television station employs four to six announcers, although larger stations employ 10 or more. In addition to staff announcers, several thousand freelance announcers sell their services for individual assignments to networks and stations, or to advertising agencies and other independent producers.

Training, Other Qualifications, and Advancement

Announcers must have a pleasant and well-controlled voice, a good sense of timing, and excellent pronunciation. Correct English usage and a knowledge of dramatics, sports, music, and current events improve chances for success. The most successful announcers have a combination of personality and a knack for dramatization that makes them attractive to audiences.

Announcers usually specialize in a particular area such as news, sports, or weather.

High school courses in English, public speaking, dramatics, foreign languages, and electronics, plus sports and music hobbies, are valuable background for prospective announcers. A college liberal arts education provides an excellent background for an announcer, and many universities offer courses of study in the broadcasting field. Students at these institutions also may gain valuable experience by supplementing their courses with part-time work at the campus radio station and summer work at local stations, filling in for vacationing staff members. A number of private broadcasting schools offer training in announcing.

Persons considering enrolling in any school, whether public or private, that offers training for a broadcasting career should contact the personnel managers of stations, broadcasting trade organizations, and the Better Business Bureau in their area to determine the school's performance in producing suitably trained candidates.

Most announcers get their first broadcasting jobs in small stations. Because announcers in small radio stations sometimes operate transmitters, prospective announcers often obtain an FCC Radiotelephone Third Class Operator License which enables them to operate a radio transmitter and, therefore, makes them much more useful to these stations.

Announcers usually work in several different stations in the course of their careers. After acquiring experience at a station in a small community, an ambitious and talented announcer may move to a better paying job in a large city. An announcer also may advance by getting a regular program as a disc jockey, sportscaster, or other specialist. In the national networks, competition for jobs is intense, and announcers usually must be college graduates and have several years of successful announcing experience before they are given an audition.

Employment Outlook

Competition for beginning jobs as announcers will be keen through the mid-1980's. The great attraction of the broadcasting field, plus its relatively small size, will continue to mean many more jobseekers than jobs. Over the next decade, it will be easier to get jobs in radio than in television because more radio stations hire beginners. These jobs generally will be located in small stations, and the pay will be relatively low.

Employment of announcers is expected to increase faster than the average for all occupations through the mid-1980's as new radio and television stations are licensed. Some jobs will become available as more cable television stations begin their own programming. Employment of announcers will not keep pace with the increase in the number of stations, however, because of the increased use of automatic programming equipment. Many jobs in this relatively small occupation will result from the need to replace experienced announcers who transfer to other occupations, retire, or die.

Earnings and Working Conditions

Salaries of beginning announcers in commercial television ranged from about $185 to $230 a week in 1976, and those of experienced announcers ranged from about $300 to $500, according to the limited information available. Many well-known announcers earn much more. As a rule, salaries increase with the size of the community and the station, and salaries in television are higher than those in radio. Announcers employed by educational broadcasting stations generally earn less than those who work for commercial stations.

Most announcers in large stations work a 40-hour week and receive overtime pay for work beyond 40 hours. In small stations, many announcers work 4 to 12 hours of overtime each week. Working hours consist of both time on the air and time spent in preparing for broadcasts. Evening, night, weekend, and holiday duty occurs frequently since many stations broadcast 24 hours a day, 7 days a week.

Working conditions are usually pleasant because of the variety of work and the many personal contacts that are part of the job. Announcers also receive some satisfaction from becoming well known in the area their station serves.

Sources of Additional Information

For general career information, write to:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

For information on how to obtain an FCC license, write to:

Federal Communications Commission, Washington, D.C. 20554.

TECHNICAL WRITERS

(D.O.T. 139.288)

Nature of the Work

Technical writers put scientific and technical information into language that can readily be understood by people who need to use it. They research, write, and edit technical materials and also may produce publications or audiovisual materials. To ensure that their work is accurate, technical writers must be expert in the subject area in which they are writing—laser beams or pharmacology, for example. At the same time, their writing must be clear and easy to follow. Command of the language and versatility of style are tools of the trade that enable technical writers to convey information in a way that is helpful to people who use it—scientists, technicians, executives, sales representatives, and the general public.

Some organizations use job titles other than "technical writer." Depending on the particular employer, people in technical writing jobs may be called publications engineers, communications specialists, industrial writers, medical writers, communicators, or instructional materials developers.

Technical writers set out either to instruct or inform, and in many instances they do both. They prepare manuals, catalogs, parts lists, and instructional materials needed by the sales representatives who sell machinery or scientific equipment and

by the technicians who install, maintain, and service it. Instructional aids must be prepared to assist the people who operate complex equipment—for example, the technicians who monitor sophisticated diagnostic equipment in a hospital's coronary care unit. Writing manuals and training aids for military weapons and equipment is a highly specialized field of technical writing. Sometimes technical writers are asked to write scripts for training films, or to prepare instructional materials for self-teaching cassettes, filmstrips, or kits.

Many technical writers prepare reports on the results of research projects. By communicating research developments to other scientists, engineers, and technicians, these reports speed scientific and technical progress and help prevent duplication of effort. Reports also play an important part within a company; hundreds of progress reports may be sent from one department to another within the course of a year. Detailed reports also must be prepared for regulatory agencies and for agencies that fund research and development projects. Some reports—environmental impact statements, for example—require such a detailed treatment of technical subjects that they usually are prepared by scientists with the assistance of technical writers. Annual reports to stockholders sometimes are an additional responsibility.

Proposal preparation is another important duty of technical writers. Proposals are requests for the money or facilities to conduct a project, develop a prototype of a new product, or do research. When a proposal is being prepared, scientists and engineers provide the technical materials, management provides the budget, and a team of technical writers usually shapes the final proposal.

Manuals, reports, and proposals make up the bulk of technical writing today; however, the work may take other forms. Technical writers may write specifications; prepare speeches and news releases; edit and write technical books; prepare articles for popular magazines; develop advertising copy, promotional brochures, and text for exhibits and displays; and handle technical documentation.

When they begin a writing assignment, technical writers usually start by learning as much as they can about the subject. They study reports, sometimes blueprints; read technical journals; consult with engineers, scientists, and technicians who have worked on the project; or examine the equipment. After they have assembled as much information as appropriate, given the time they have and the purpose of the document, they draw up an outline. Then they prepare a rough draft, which may undergo several revisions before being accepted in final form. Technical writers usually arrange for the preparation of tables, charts, illustrations, and other artwork that accompanies a finished document and may work directly with technical illustrators, drafters, or photographers.

Places of Employment

An estimated 22,000 technical writers and editors were employed in 1976. Many work for large firms in the electronics, aviation, aerospace, ordnance, chemical, pharmaceutical, and computer manufacturing industries. Firms in the energy, communications, and computer software fields also employ many technical writers.

Research laboratories employ significant numbers of technical writers. Some laboratories are affiliated with manufacturing companies to concentrate on developing products or improving the manufacturing process. Other research laboratories—including those connected with universities, government agencies, or private foundations—engage in both basic and applied research.

The Federal Government employs technical writers and editors in areas as diverse as the physical sciences, weapons development, agriculture, health, and space exploration. Three out of four technical writers and editors in the Federal Government work for the Department of Defense. Other agencies that employ technical writers include the Departments of Interior; Agriculture; Health, Education,and Welfare; and the National Aeronautics and Space Administration.

Many people in this occupation work directly for publishing houses. They hold writing and editing jobs with business and trade publications; professional journals in engineering, medicine, physics, chemistry, and other sciences; and publishers of scientific and technical literature.

The rapidly growing information industry provides a new area of employment for technical writers. Commercial firms that provide their clients with access to a computerized data base employ technical information specialists to collect, process, and manage a vast amount of information. Technical writers are particularly well suited for such jobs because of their combination of technical and communications skills. Such jobs also are available at the technical information centers run by major industrial firms and research laboratories.

Established technical writers may work on a free-lance basis or open their own agencies or consulting firms.

Technical writers are employed all over the country but the largest concentrations are in the Northeast, Texas, and California.

Training, Other Qualifications, and Advancement

There are no rigid requirements for entry into the field. As a result, people having a variety of backgrounds find jobs as technical writers. Employers seek people whose educational background or work experience indicates that they are familiar with a technical subject and can write about it effectively. Knowledge of graphics and other aspects of publication production may be helpful in getting a job. An understanding of current trends in communication technology is an asset, and familiarity with computer operations and terminology is increasingly important.

A college degree is helpful, and many employers insist on it. Hiring criteria vary, however. Many employers prefer candidates with a degree in science or engineering plus a minor in English, journalism, or technical communications. Other employers emphasize writing ability and, in turn, look for candidates whose degrees are in journalism or the liberal arts. Depending on their line of business, these employers almost always require course work or

practical experience in a specific subject as well—computer science or biochemistry, for example.

Besides having writing skills and scientific or technical expertise, technical writers should be intellectually curious and able to think logically. They must be very accurate in their work and must be able to deal precisely with a mass of detailed material. Because they often work as part of a team, they should be able to work with others; this requires tact and a cooperative attitude. Technical writers sometimes work alone for long periods with little or no supervision, so they must also be disciplined about work habits and schedules.

Most technical writers do not enter the occupation directly from college. The majority work initially in other jobs, usually as technicians, scientists, or engineers. Some begin as research assistants, editorial assistants, or trainees in a company's technical information or advertising department. In time, these people may assume writing duties and develop technical communication skills. When a flair for writing becomes evident, they may seek a technical writing position in the same company or find a writing job elsewhere.

While many employers consider only seasoned, experienced writers in filling vacancies, not all do. Some firms hire college graduates for writer trainee positions. People with solid backgrounds in science or engineering are at an advantage in competing for such jobs. Those with bachelor's or master's degrees in technical writing are often preferred over candidates who have little or no writing background. However, a degree in almost any field may be acceptable, providing the candidate has the necessary technical and communications skills. Beginners can develop experience and demonstrate their ability through writing material for local weekly newspapers and by publishing articles in student journals. A portfolio of writing samples is helpful when applying for a job.

The majority of technical writers have work experience as technicians, scientists, or engineers.

In 1976, 40 colleges and universities offered programs leading to a bachelor's degree in technical writing, and 4 schools had associate degree programs. Graduate programs leading to a master's degree in technical writing were offered at six schools, one of which also offered a Ph. D. These programs have various names, including science or medical writing, science information, technical journalism, and technical communication.

Most undergraduate programs in technical writing are interdisciplinary. While such programs may be based in the communications, journalism, or language and literature department, they generally are given in close cooperation with the mathematics, engineering, and science departments. At most schools, about 30 percent of the student's course work is in communications. Typical courses include communication theory, writing and editing, layout and design, and graphics. From 25 to 40 percent of the courses are in science or technology. The remainder of the program may be in the social sciences and humanities, or may be devoted entirely to electives. Students usually are advised to take courses in related fields such as computer science and statistics. At many schools, internships in industry or government give students in the technical writing program an opportunity for first-hand job experience.

Graduate programs in technical writing emphasize the field of communications. Many graduate students in technical writing already have a bachelor's degree in science, engineering, or technology. Others come from liberal arts backgrounds. A typical graduate program includes courses in the theory of communication, writing and editing, technology assessment, and management.

Although only a few schools offer degrees in technical writing or technical illustrating, hundreds of colleges and universities offer one or more courses in these fields. Students with such diverse majors as agriculture, chemistry, engineering, and business administration can elect courses in advanced composition, copy editing, typography, technical advertising, industrial communications, and proposal writing, for example. Many engineering schools offer English courses to sharpen writing skills, and several have developed extensive course offerings in technical writing. Several schools of journalism offer courses in medical journalism.

Numerous special institutes, seminars, and workshops are available to bring technical writers up to date. Some take the form of intensive 1- or 2-week summer seminars sponsored by colleges and universities. Others are workshops run by technical communication consultants or by organizations that specialize in employee training and development.

Beginners often assist experienced technical writers by doing library research and preparing drafts of reports. Experienced writers in companies with large technical writing staffs may move to the job of technical editor or shift to an administrative position in the publications or technical information departments. The top job is that of publications manager, who normally supervises all of the people directly involved in producing the company's technical documents. The manager supervises not only the technical writers and editors, but also the staff responsible for illustrations, photography, reproduction, and distribution.

After gaining experience and contacts, some technical writers freelance or form their own firms. Some consulting firms handle industrial publicity and technical advertising for corporate clients. Other technical communications firms do the actual writing and production of the catalogs, manuals, and brochures that may be needed for the promotion of a new product, for example. Successful technical writers are frequently in demand to conduct writing seminars in industry and government, and

some teach at colleges and universities in addition to their regular jobs.

It also is possible to advance by becoming a specialist in a particular scientific or technical subject. These writers sometimes prepare syndicated newspaper columns or articles for popular magazines.

Employment Outlook

Employment of technical writers is expected to increase about as fast as the average for all occupations through the mid-1980's. In addition to openings due to growth, opportunities will result from the need to replace those who die, retire, or transfer to other occupations. Employment opportunities will be best for experienced technical writers and for beginners who have both writing ability and a scientific or technical background. People who cannot demonstrate both a technical background and communications skills may face stiff competition for beginning jobs.

Demand for technical writers is expected to increase because of the continuing expansion of scientific and technical information and the need to communicate research results to the scientific community as effectively as possible. Also contributing to the demand for technical writers is the growing need to put scientific and technical information into language that corporate managers, sales representatives, and service technicians can understand. With the increasing sophistication and complexity of industrial and scientific equipment, more and more users will depend on the technical writer's ability to prepare explanations and instructions in precise but simple terms.

Government expenditures for research and development (R&D) will continue to have a significant effect on job opportunities for technical writers. Their employment, like that of scientists and engineers, is linked to spending levels for basic research and for product development in such important areas as defense, space exploration, energy, pollution control, medicine, and communications technology. Through the mid-1980's, R&D expenditures are expected to increase, but growth will be slower than it was during the peak period of the 1960's.

Relatively few job openings are expected in the Federal Government. The number of technical writers and editors employed by Federal agencies has declined since the late 1960's, and most vacancies will occur as Federal employees retire or transfer to other jobs.

Earnings and Working Conditions

Salaries depend not only on the amount and kind of education a technical writer has, but also on experience and the ability to produce. The type, size, and location of the employer also are important. Earnings generally are higher on the East Coast and in California than in other parts of the country. Free-lancing can be an important source of additional income, but freelance earnings vary greatly because they depend on the writer's ability and reputation.

Starting salaries for college graduates began at about $10,000 in 1976, although graduates with degrees in engineering, science, or technical communications generally began at $12,000 or more. Experienced technical writers averaged around $19,500 a year in 1976, while those in supervisory positions earned $25,000 or more. There were substantial regional variations, however.

In the Federal Government in 1977, beginning technical writers with a bachelor's degree and about five science courses were paid $9,303 a year; those with a bachelor's degree and 1 year's specialized experience could start at $11,523 a year. The average salary for technical writers in Federal agencies was $19,901.

Technical writers, in and out of government, may work under considerable pressure, frequently working overtime to meet publication deadlines. Their working environment generally is clean and well-lighted.

Sources of Additional Information

For information about careers in technical writing, and the names of colleges and universities that offer programs in technical communication, contact:

Society for Technical Communication, Inc., Suite 421, 1010 Vermont Ave. NW., Washington D.C. 20005.

For information about careers and workshops in the field of health communication, contact:

American Medical Writers Association, Suite 290, 5272 River Rd., Bethesda, Md. 20016.

The Outlook for Industries

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AGRICULTURE

For decades the word agriculture has referred to agricultural production or farming—a major American industry that employed over 3 million workers in 1976. But today this word encompasses more than just farm production. Agriculture is closely related to many other industries in the economy—food and fiber processing, marketing and distribution industries, farm implement producers and dealers, and feed and fertilizer manufacturers.

Although jobs requiring agricultural knowledge or skills long have been available in off-farm locations, the number and variety of these agricultural jobs have increased dramatically in recent years. At the same time, significant improvements in agricultural productivity have reduced the number of jobs actually available on the Nation's farms. During the last two decades, employment on U.S. farms and ranches has declined to only half its former level. Improved agricultural technology has been among the factors that have reduced employment on farms and created a need for workers with agricultural skills in off-farm occupations.

Although future growth in agricultural employment will be in off-farm occupations and industries, about 2 million workers still will be needed in basic agricultural production in 1985. This statement begins with a discussion of the occupations in basic farm production and the factors to consider in making the decision to farm. Subsequent sections describe the increasing variety of work available in the growth sector of agriculture—off-farm businesses, occupations, and professions utilizing agricultural skills.

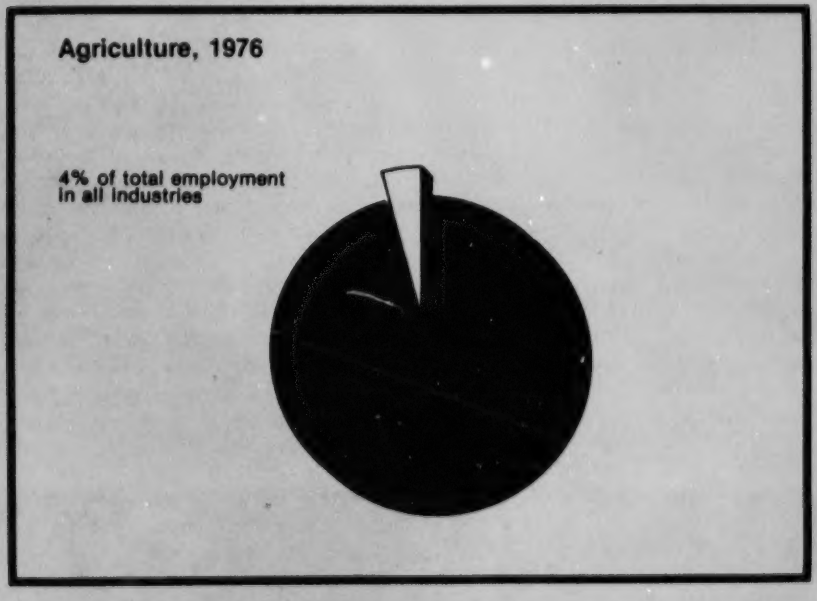
Occupations in Farm Production

Farmers and farm workers accounted for over 95 percent of all farm employment in 1976. Although most farmers and farm workers are engaged in growing crops, over 1 million raise livestock. Because activity on many farms is seasonal, some farm employees work 3 months or less during the year. This seasonality of farm production enables many small farm owners to hold another job while working their farms part time.

Although employment on most farms is limited to the farm operator and one or two family workers or hired employees, large farms often have 100 full-time workers or more. Some of these are in nonfarm occupations, such as truckdrivers, sales representatives, and clerks.

Farm Operators. Three out of every four farms are operated by an owner or *tenant farmer* (D.O.T. 409.181). The remainder are run by hired farm managers or partners. The specific tasks a farm operator must do are determined by the type of farm he or she runs, but, in general, farmers are responsible for planning, tilling, planting, fertilizing, cultivating, and harvesting crops. Those who raise livestock must feed and care for their animals and keep barns, pens, milking parlors, and other farm buildings clean. Farmers also perform various other tasks, ranging from setting up and operating machinery to erecting fences and sheds. The size of the farm often determines which of these tasks operators will handle themselves. Operators of large farms have employees do much of the physical work that small farm operators do themselves.

In addition to the physical work that farm operators must do or arrange to have done, they also must make the management decisions required of modern agricultural production. Farm operators must carefully plan the combination of crops they grow so that if the price of one crop goes down they will have sufficient income from another to make up for it. Also, prices of crops and livestock change from one month to another, and farmers who plan ahead may be able to store their crops or



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keep their livestock to take advantage of better prices later in the year.

Farm operators make other important management decisions, such as determining when to seed, fertilize, cultivate, and harvest. After harvesting, they make sure that products are packaged, loaded, and delivered promptly to market. If necessary, they secure loans from credit agencies to finance the purchase of machinery, fertilizer, livestock, and feed. They also keep financial records of the farm operation, and train and supervise family and hired workers in the use of equipment and performance of farm chores.

Tenant farmers rent their land. Although they often manage their farm operations, they sometimes consult the land owner or hired manager when deciding what to plant or scheduling the harvest. Tenant farmers also supervise the work of family and hired laborers. Although tenant farmers generally provide their own machinery, livestock, seed, and fertilizer, under special agreements the land owner may furnish one or more of these. Most tenant farm operators turn over an agreed-upon percentage of the crop to the land owner for the use of the land. Others may pay a flat yearly rent to the land owner.

Farm laborers and farm labor supervisors. Very few farms today can be run by only one person. In 1976, approximately 975,000 hired workers, 340,000 family workers, and 30,000 farm labor supervisors were employed on farms.

On many farms, especially those that rely on a few family workers or hired employees, farm laborers perform a variety of duties. For example, *farm hands* (D.O.T. 421.883) on a farm devoted to diversified agriculture may care for livestock and crops as well as maintain structures and equipment.

Livestock generally require a great deal of attention on a day-to-day basis. Farm hands must mix feed and additives, and fill feed and water troughs. They clean barns and animal pens and check livestock regularly for signs of disease or infection. Often farm hands must vaccinate livestock, such as cattle and poultry, against diseases or spray them with insecticides to protect against harmful parasites. Also, farm hands on dairy farms must clean and milk cows twice a day.

In contrast, hands on crop farms have duties that vary with the seasons.

Before seeding, they must prepare the soil by plowing, harrowing, and fertilizing. Once the crops are partially grown, they cultivate fields to loosen soil and reduce the number of weeds. Often, crops are sprayed to control weeds, harmful insects, and fungi. Farm hands also assist in harvesting, and storing, packing, and transporting crops.

Many of the tasks performed by farm hands require the use of machinery, such as milking machines, hay balers, and cotton pickers. In addition to setting up and operating machinery, hands maintain and clean it and may do minor repairs, if necessary. Also, they maintain and repair farm structures, including barns, fences, and irrigation systems.

Farm hands generally perform some, or all, of these duties regardless of farm location or what crops are grown. However, many types of crops require special attention. For example, a farm hand working in an orchard (D.O.T. 404.883) may have to transplant seedlings, prune fruit trees, thin immature fruit to improve quality, and prop up overloaded branches.

Other farm laborers may perform specialized job duties depending on the location of the farm. In areas where rain is insufficient, *irrigators* (D.O.T. 422.887) water crops by controlling the flow of water from irrigation ditches, through gates or portholes, to the fields. They also operate portable sprinkling systems that pump water through pipes spread on the ground, and move the pipes from one area of the field to another.

Farms such as those producing fruit or vegetables often need a large number of woqkers to harvest their crops. These farms employ laborers with more specialized job duties. For instance, if produce is packed on the farm to prepare it for shipment, then *produce sorters* (D.O.T. 529.687) and *produce packers* (D.O.T. 920.887) will be employed. Other laborers may spend most of their time operating a particular piece of machinery. Still others may be full-time maintenance workers.

When many workers are employed in specialized jobs, *farm labor supervisors* (D.O.T. 429.131) are needed to coordinate work activities such as planting, cultivating, and harvesting. They schedule the work of crews and may hire additional hands, especially during the harvesting season. Farm labor supervisors also teach new employees how to use machinery and tools and keep records of production and crop conditions. (For additional information on labor supervisors, see the statement on blue-collar worker supervisors, eleswhere in the *Handbook*.)

Places of Employment

Some farming is done in nearly every county in the United States, but more than one-third of all farms are in the following States: Texas, Missouri, Iowa, North Carolina, Illinois, Kentucky, and Tennessee. Thus, employment of farm operators is concentrated in these States. Farms in some of these States, however, are smaller on the average than those in other areas of the country, and more than one-third of all farm products are raised in Iowa, California, Texas, Illinois, and Kansas.

Often the topography of the land and the climate of an area determine the type of farming that is done. For example, wheat, corn, and other grains are most efficiently grown on large, flat farms on which large and sophisticated machinery can be best used. Thus, these crops are ideal for the Plains States of Kansas, Nebraska, Iowa, and Illinois. Other States such as Wisconsin, Minnesota, and New York have rolling hills, sufficient rainfall to provide good pastures, and denser populations, and thus smaller farms that are ideal for grazing dairy herds. Climate is the main reason why crops which require longer growing seasons, such as cotton, tobacco, and peanuts, are grown chiefly in the South.

About three-fifths of all farmers and farm workers are employed raising crops; the remainder raise cattle, hogs, sheep, and poultry.

Raising fruits and vegetables, which must be picked and packaged by hand, generally requires a large

number of employees during the harvesting season. Thus many hired laborers work on these farms on a seasonal basis. About one-half of all commercial vegetables grown in the United States are produced in California, and large amounts of fruits and vegetables also are grown in Texas and Florida. Two-fifths of all farm labor supervisors and one-third of all hired farm laborers are employed in these three States.

Much of the work on farms that produce animals and dairy products is on a day-to-day basis, so these farms often rely on the farm operator and several unpaid family laborers to do most of the work. Unpaid family workers and farm operators also provide most of the labor on farms that produce crops, such as wheat, corn, or cotton, that can be machine harvested and packaged without damage. Therefore, only a small number of hired farm laborers and almost no farm labor supervisors are employed in the regions that produce these farm products.

Training, Other Qualifications, and Advancement

Modern farming is very costly and usually requires a large initial investment. The prices of farmland, fertilizer, hybrid seeds, and other resources needed by farmers have risen dramatically over the past decade. Also, more expensive machinery is needed today to farm efficiently. To obtain the financing necessary to get started in farming, prospective farmers must be able to show that they are well trained and knowledgeable in their field.

Growing up on a family farm and participating in farming programs for young people, such as the Future Farmers of America or the 4-H Clubs, is still an important source of training for tomorrow's farmers. However, because of the complexities of modern scientific farming and the need to keep up with advances in farming methods, an increasing number of young farmers find it desirable to receive additional training at a 2- or 4-year college of agriculture. Also, a degree in agriculture is almost essential for persons who wish to farm but who have not had the advantage of living or working on a farm in their youth.

Most colleges of agriculture offer major programs of study in areas such as dairy science, crop science, agricultural economies, horticulture, and animal science. Also, colleges usually offer special programs of study concerning products that are important to the area in which they are located, such as grain science programs at colleges in the Plains States.

In addition to the knowledge of agricultural practices that farming requires, a wide variety of building, maintenance, and business skills often are needed on farms. On corporate farms and on large, established, family farms, there may be many workers, each supplying a particular skill. However, beginning farmers may wish to supply as much labor as possible to the operation of the farm in order to hold down costs, so it often is helpful for them to have these other skills. The carpentry skills needed to erect or repair fences and farm buildings may be learned in courses at vocational schools, as can farm machinery maintenance and repair. Sound business practices can be learned through high school courses in bookkeeping, and the knowledge of financial management, accounting, and tax accounting that is almost essential to today's farmer can be obtained through college courses.

In contrast to the extensive and varied training needed to be a farm operator, most farm laborers, such as field and livestock workers and packinghouse workers, learn their jobs in a matter of hours on the farm and require little or no outside training. Some farm laborers on large farms perform more specialized jobs, such as machine operator, for which limited experience may be helpful, but previous experience and training are not necessary.

Farm laborers and farm operators should be in excellent physical condition. Physical stamina and strength are important to farm workers, since they must often work long days on their feet or stooped over under the hot sun, and they may be required to lift and carry heavy objects, such as hay bales, or to restrain animals.

Over 1.5 million acres of farmland in the United States are lost each year to suburbanization, and in many areas of the country farmland for sale is scarce. The scarcity of available land and the large cost of getting started in farming, may make it necessary for a beginning farmer to start out as a hired hand on a nearby farm, or as a tenant farmer for a land owner who supplies the machinery, seed, and fertilizer in return for a percentage of the crop. Hired hands and tenant farmers may later find jobs as farm managers or one day become owners of their own farms.

Opportunities for advancement for farm laborers are very limited; however, they may advance to become farm labor supervisors and a few may have the opportunity to become working farm managers, tenant farmers, or to one day own their own farms.

Making the Decision to Farm

Farming may be the ideal career for people who enjoy working outdoors and being their own bosses. The desire to live in a rural area, away from urban congestion, also may be an important consideration in choosing farming as an occupation. However, farming is a very demanding career, and only persons with a great deal of initiative and a sense of responsibility can expect to be successful.

Farmers often must work long hours. A 6- or 7-day workweek is common during busy seasons and is the rule on certain types of farms, such as dairy and livestock farms. Farmers should be willing to try new processes and adapt to constantly changing technologies to produce their crops or raise their livestock more efficiently. Farmers also must have enough technical knowledge of crops and growing conditions and plant and animal diseases to be able to make decisions that insure the sucessful operation of their farms. They also must have the managerial skills necessary to organize and operate a business. Mechanical aptitude and the ability to work with tools of all kinds also are valuable skills for the operator of a small farm who often must maintain and repair machinery or farm structures. A basic knowledge of accounting and bookkeeping can be helpful in keeping

financial records, and a knowledge of credit sources is essential.

Both the average size of farms and the price of farmland have increased greatly in recent years, thus considerably raising the cost of buying a farm. Therefore, young people interested in farming may wish to start by farming part of a relative's farm or by leasing land from an absentee owner. However, even if the beginning farmer does not purchase land and buildings, financing is generally necessary to purchase livestock, seed, feed, fertilizer, and machinery.

The Federal Land Bank is the largest source of credit for farmers. In addition, many commercial banks and savings and loan institutions, especially those in rural areas, and many life insurance companies, extend credit to farmers. Also, the Farmers Home Administration extends credit for purchasing farms and paying for yearly operating costs to people who have been unable to obtain loans from any other source.

Employment Outlook

Employment in the agriculture industry is expected to continue to decline through the mid-1980's, as the trend toward fewer but larger farms continues. Fewer farms means fewer farm operators, and as farms become larger, the additional use of more and larger machinery makes it unnecessary to hire more farm laborers.

Beginning farmers who wish to grow crops such as grain crops or cotton, which often are profitably produced on farms of 1,000 acres or larger, will find extremely limited opportunities, since farms of this size rarely are available for purchase, and those that are cost a great deal. Beginning farmers should find more opportunities to get started in a type of specialty farming that requires less land, and in which they have an expertise. For example, a successful family dairy farm may require only 100-160 acres of pasture and cropland. Specialty crops such as tomatoes, strawberries, or watermelons may be profitably grown on even smaller farms using intensified farming methods.

Opportunities for beginning farmers may be best in rural areas in the Eastern and Southern regions where there are many small farms. However, many farms on the fringes of metropolitan areas in these regions are being lost each year to suburbanization, and thus the price of this farmland should continue to increase.

Employment of farm laborers will decline as the number of farms declines and as machinery replaces much of the work that laborers now do. For example, an improved hybrid tomato has been developed that has hard skin and can be machine harvested without damaging the tomatoes. Now one machine can do the harvesting work that formerly required many hand laborers.

As the cost of farming increases, fewer individuals will be able to afford the initial investment needed to get started in farming, and the number of large corporate and partnership farms that employ more workers per farm will increase. Since these types of farms usually are operated by farm managers, employment of farm managers is expected to increase about as fast as the average for all occupations through the mid-1980's, and beginning farmers may find opportunities in this field.

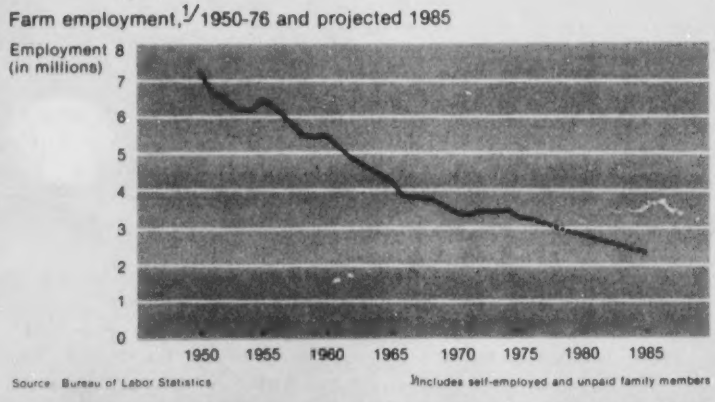
Earnings and Working Conditions

No information is currently available on the average earnings of farm operators. Earnings of farm operators vary greatly from year to year and by type and size of farm. Prices of many farm products fluctuate greatly depending on weather conditions which determine the amount and quality of products that are produced. A farm that shows a large profit in one year may show a loss in the following year.

Farm laborers are generally among the lowest paid workers; in 1976 average hourly earnings of all hired farm workers were only $2.66. In comparison, average hourly earnings of all production workers in private nonagricultural industries were $4.87 in the same year. Average wage rates for hired farm workers ranged from $2.47 an hour for field and livestock workers to $4.39 an hour for farm labor supervisors. In general, workers paid on a piece-rate basis earned more than those who received a straight hourly wage. In addition to their wages, some hired farm workers receive room and board allowances; however, almost no farm workers receive benefits such as paid vacations, sick leave, or health benefits.

Many types of agriculture are very seasonal in nature and many farm operators and farm laborers on crop farms may have to work from sunup to sundown during the planting and

Even though farm output has increased by 50 percent since 1950, employment has been cut in half and is expected to continue to decline



Over 1 million farmers and farm workers raise livestock.

harvesting seasons. Farm workers often work fewer than 6 to 7 months a year on the farm, and, while many can find off-farm employment, others are often unable to find outside employment during the winter months.

On farms on which animals are raised for meat or dairy products, the work is distributed more evenly throughout the year. However, these farms cannot be left unattended since animals must be fed and watered regularly, and cows must be milked twice daily. Owners and operators of these farms may rarely get the chance to travel.

For many people, living on a farm or in a rural area is an attractive alternative to the fast-paced life of a metropolitan area. However, farm work can be extremely hazardous. Each year many farm workers suffer debilitating injuries from farm machinery. Also, farm workers are subject to illnesses and diseases from handling and breathing in dangerous pesticides and chemicals and from handling crops that have been sprayed with insecticides. In addition to these problems, health care in rural areas sometimes is inadequate or too expensive to meet the needs of farm workers.

Many farm laborers, especially those in California, are represented by the United Farmworkers Union (UFW), and others are represented by the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers. Many of them are members of local and regional cooperatives that enable them to reduce the cost of their supplies and also to market their products.

Agricultural Service Occupations

The agricultural services industry offers careers in hundreds of occupations, many requiring specialized skills or the ability to operate farm equipment. In 1976, approximately 250,000 people provided crop and animal services to farmers and farm cooperatives. Most worked for small companies or were self-employed. Although about half of these people are employed as laborers, many others work in professional occupations, such as veterinarians or agricultural scientists. Others work as managers, agricultural technicians, writers, mechanics, machine operatives, clerks, and secretaries.

Many occupations in the agricultural services industry are well-suited to individuals who enjoy working with animals. These occupations vary greatly in skill requirements, from professions requiring college training to jobs that may be learned in a few days or by merely growing up on a farm and observing the tasks being performed.

Veterinarians (D.O.T. 073.081) provide health care services to livestock and small pets. They inspect livestock at public stockyards and at points of entry into the United States to keep diseased animals out of the country and prevent the spread of disease. They also administer tests for animal diseases, conduct programs for disease eradication, and carry out research to develop vaccines for disease control. (Veterinarians are discussed in more detail elsewhere in the *Handbook*.) *Animal breeders* (D.O.T. 419.181) use their knowledge of genetics and ranch or dairy management to develop improved breeds of animals that will be more productive. They conduct tests on new breeds of livestock to determine growth rates for beef cattle and milk production for dairy cattle. Breeders also maintain records on offspring of new breeds with an animal breeding association or on their own. *Artificial-breeding technicians* (D.O.T. 467.384) and *artificial inseminators* (D.O.T. 467.384) collect semen from male livestock such as bulls and rams, and artificially impregnate cows and ewes. These workers may be employed by animal breeding associations or by *artificial breeding distributors* (D.O.T. 180.168) who manage insemination distributorships.

Several occupations in livestock services may be learned more easily. Cow testers employed by dairy herd improvement associations travel from farm to farm to test the milk from each cow in a herd for acidity and butterfat content and record the results. Cattle dehorners remove the horns from cattle to prevent injuries to other animals in the herd, and often provide castrating and vaccinating services, as well. Poultry hatcheries employ several types of animal caretakers to vaccinate poultry, place eggs on trays in incubators, and

care for baby chicks being used in experimental tests.

In addition to workers who supply animal services, others provide custom crop services or other general crop services, often on a contract basis. Although most crop services are provided by self-employed individuals or small businesses with 10 or fewer employees, larger service businesses employ people with professional and technical skills, as well as laborers and machine operators. Professional managers are needed to direct the work of employees as well as manage the business. Also, professional farm managers, who are generally college trained, provide farm management services to absentee land owners and their tenants. They schedule the plowing, fertilizing, planting, cultivating, and harvesting of fields, and the marketing of crops and livestock. Often they work for businesses which specialize in supplying these services; however, some are self-employed.

Other occupations in this field require technical skills or specialized equipment, but can be learned through technical training, on-the-job training, or training in another job. For example, *agricultural pilots* (D.O.T. 196.283) and their assistants mix agricultural chemicals and apply them while flying airplanes or helicopters over fields at low altitudes. They also seed an increasing number of fields from the air. Also, some airplane mechanics are employed to repair and maintain agricultural aircraft.

In contrast to those occupations that require professional or technical training, farm service laborers work in occupations that may be entered merely by having the necessary equipment or by being familiar with farm operations. For example, grain elevator operators who have grain drying equipment may provide grain drying and storage services, and agricultural chemical dealers may provide fertilizer hauling and spreading and crop dusting services. Sometimes farmers with special equipment supplement their incomes by providing corn shelling, hay baling, threshing, or other services to farmers in their area. Employees of seasonal service businesses often must work long hours and 6 or 7 days a week during the busy season.

Farm labor contractors and crew leaders also require no special training. However, they must establish contacts with farmers and farm managers to whom they supply farm laborers, especially harvest laborers, on a contract basis at specified times of the year. (Farm laborers employed by contractors and crew leaders receive better social security coverage by having only one employer).

Sources of Additional Information

The most significant sources of information and guidance available to farmers are the services provided by the land-grant colleges and universities and the U.S. Department of Agriculture, Washington, D.C. 20250. These services include research, publication, teaching, and extension work. The county agricultural agent is often the best contact for the young person seeking advice and assistance in farming. The Farmers' Home Administration system of supervised credit is one example of credit facilities combined with a form of extension teaching. Organized groups, such as the Future Farmers of America and the 4-H Clubs, also furnish valuable training to young farm people.

For information about opportunities in off-farm activities, contact individual colleges of agriculture or the U.S. Department of Agriculture, Washington, D.C. 20250.

Jobs in Agribusiness

Agribusiness occupations, broadly speaking, are those in off-farm settings that demand agricultural knowledge or skills. Some can be learned in a few days by persons who have lived or worked in rural areas or on farms. Others require training in technical schools, junior colleges, colleges and universities, from a few months duration to as long as several years. Although all industries offer some agribusiness jobs, they tend to be concentrated in the manufacturing, trade, agricultural services, and government sectors.

Since agribusiness occupations are so varied and numerous, this section deals only with selected jobs in the field—those that best represent the different types of work available. See the "Sources of Additional Information" portion of this statement for a guide to other materials on specific agribusiness jobs.

Professional and Technical Occupations in Agribusiness. One of the oldest areas of professional work in agribusiness involves collecting, compiling, and analyzing data. Workers in these jobs have titles that reflect the particular setting in which they are employed; most are agricultural accountants, marketing specialists, and agricultural economists or statisticians.

Agricultural accountants prepare and analyze financial reports that managers use to make important decisions. They may specialize in tax matters, such as preparing income tax forms and advising farm managers and operators about the tax advantages and disadvantages of business decisions. Accountants employed by hardware and farm supply retail businesses, such as dairy equipment stores and farm machinery stores, often need a knowledge of agriculture to perform their jobs.

Agricultural marketing specialists survey wholesalers, retailers, and consumers; analyze data on products and sales; and prepare sales forecasts that businesses use to make decisions relating to product design and advertising. The results of their research are used by food processing companies to create food products that consumers will buy, and by agricultural suppliers to develop products for agribusiness and industrial firms. Marketing specialists also work for commodity brokerage firms, farm organizations, cooperative marketing and purchasing organizations, and research divisions of the Federal Government.

Agricultural economists (D.O.T. 050.088) deal with problems related to production, financing, pricing, and marketing of farm products. They provide information to policymakers, agribusinesses, farmers, and other sectors of the agriculture industry. Many work for the U.S. Department of Agriculture, developing cost-benefit analyses for evaluating farm programs at the national, State, and local levels. As part of their analysis,

economists study the effects of mechanization and technological advances, for example, on the supply of and demand for farm products and the resulting impact on costs and prices. Others work for farm lending institutions, such as rural banks, The Farmers Home Administration, The Federal Land Bank, and insurance companies that make loans to farmers, determining the feasibility of loan programs and individual loans. Many agricultural economists also work for businesses which manufacture products and provide services for farmers, such as farm equipment. Still others work for agribusiness firms that market agricultural products at both retail and wholesale levels. Agricultural economists who have advanced degrees may teach at colleges and universities. There also are opportunities for agricultural economists in the Foreign Service, conducting research to improve the productivity of agriculture aboard.

A more recent, but expanding, field in agriculture is agricultural communications. Persons employed in this area perform the vital job of keeping farmers, consumers, and others concerned with the agriculture industry abreast of current developments in farm technology, research, and consumer products. Crop reporters and market news reporters are employed by the U.S. Department of Agriculture in field offices throughout the United States. Crop reporters gather information on crop production throughout the growing season. Market news reporters collect information on the movement of produce from the farm to the market.

Other agricultural journalists, such as reporters and editors, collect farm news and data for publication in farm journals, magazines, bulletins, and for broadcast. Some may have job titles, such as livestock editor, that reflect their area of special knowledge. Agricultural journalists also are employed as farm directors for radio and television broadcast stations in farming areas to report on prices, sales, crop conditions, and other agricultural information of importance to farm residents. Still others are employed in communications departments of agribusiness firms to develop advertisements and public relations bulletins.

Agricultural education is an important and growing area of employment of professional workers in the field of agriculture. Because of the constant changes in production processes and technological innovations in farming, teachers are a vital link between agricultural researchers and future farmers. *School teachers* (D.O.T. 091.228) in vocational agriculture instruct secondary school and adult education classes in farm management, agricultural production, agricultural supplies and services, operation and repair of farm equipment and structures, inspection and processing of farm products, and ornamental horticulture. An increasing number of 2-year programs that require trained educators are taught at junior colleges. Colleges and universities employ many agricultural professors to teach as well as to do research and publish their findings.

Cooperative extension service workers (D.O.T. 096.128) also do educational work in fields such as agricultural production and home economics and may conduct agricultural educational programs through youth groups such as the 4-H Clubs.

Another very important area of agriculture involves scientists who conduct research vital to the development of more productive plants and animals, and better food products for consumers. Although agricultural researchers are employed in almost all sectors of the economy, the largest concentrations are in government agencies. The U.S. Department of Agriculture employs researchers in various parts of the country, including Washington, D.C., the Agricultural Research Center at Beltsville, Md., and at land grant colleges. State agricultural experiment stations employ researchers, as do other government agencies such as the Food and Drug Administration. Still other agricultural scientists do research at private colleges or for agribusiness firms, such as food processors, fertilizer and agricultural chemical manufacturers, and manufacturers of feed, seed, and farm equipment.

The following list of occupations is not complete, but is a representative sample of agricultural researchers. Many of these occupations are discussed in more detail elsewhere in the *Handbook* (see index).

Agronomists (D.O.T. 040.081) conduct experiments in field crop problems and develop new methods of growing crops to make farming more efficient, obtain higher yields, and improve quality. They study methods of planting, cultivating, and harvesting field crops such as cereals, grains, legumes, grasses, cotton, and tobacco. They also study the effect of various climates on crop production.

Plant pathologists (D.O.T. 041.081) study the causes of plant diseases to develop methods to control noxious weeds, insect pests, and plant diseases.

Plant physiologists (D.O.T. 041.081) study the structure of plants and factors which affect their growth, such as respiration, metabolism, and reproduction. They also are concerned with methods of improving the storage life of fruits and vegetables.

Geneticists (D.O.T. 041.081) try to develop strains, varieties, breeds, and hybrids of plants and animals that are better suited than those presently available for the production of food and fiber.

Microbiologists (D.O.T. 041.081) study bacteria and other microorganisms to better understand their relation to human, plant, and animal health, and learn how these microorganisms function in the production of vitamins, antibiotics, amino acids, alcohols, and sugars.

Animal physiologists (D.O.T. 041.081) study the functions of various parts of the bodies of livestock.

Animal scientists (D.O.T. 040.081) are concerned with production and management of farm animals. They conduct research in the selection, breeding, feeding, and marketing of farm animals and develop improved methods of housing, sanitation, and parasite and disease control. Some are called animal nutritionists, and specialize in finding feed requirements that will maximize production and developing new livestock and poultry feeds.

Entomologists (D.O.T. 041.081) study beneficial and harmful insects. They identify the populations and distributions of insects that injure agricultural products during growth, shipping, storage, processing, and distribution. Their research is directed toward finding ways to control harmful insects and manage beneficial ones.

Human nutritionists (D.O.T. 077.128) study the means by which the body utilizes foods and nutrients, and their relation to health and disease. They also study social, economic, and cultural aspects of food to determine how the diets of people may be improved.

Seed analysts (D.O.T. 040.381) conduct tests on samples of seeds to determine their rate of germination, purity, and noxious weed content.

Agricultural chemists (D.O.T. 022.081) conduct research to improve crop yield and promote soil conservation. They develop chemical compounds for use in controlling insects, weeds, fungi, and rodents. They also perform experiments to determine proper usage of fertilizers and investigate the problems of nitrogen fixation in soils.

Food chemists (D.O.T. 022.081) such as dairy products chemists and cereal chemists develop new foods, food preservatives, and similar products. They study how various methods of preserving foods affect nutrient content and taste, and test food samples to ensure that they meet government standards for quality and purity.

Soil scientists (D.O.T. 040.081) study the physical, chemical, and biological characteristics and behavior of soils and classify them according to a national system. They determine the ability of various soils to produce certain crops.

Rural sociologists (D.O.T. 054.088) study the structure and functions of social institutions, such as customs, practices, and laws, that are a part of rural society and thus affect farm residents.

In addition to these agricultural researchers and scientists, *agricultural engineers* (D.O.T 013.081) develop the physical layout of farms, such as the placement of barns, sheds, and irrigation systems, used to carry out production. Many agricultural engineers work for manufacturers of farm implements and machinery, designing equipment that enables farmers to increase their production. Others design improved farm structures, such as dairy barns or irrigation systems, and some work for electric utility companies developing efficient methods of utilizing electric power on farms and in food processing. Still others are employed by the Federal Government in soil and water management. Agricultural engineers with advanced degrees may also teach at colleges and universities.

In addition to the many agriculture-related professional occupations for which a college degree is necessary, there are a number of occupations of a technical nature that do not always require college training. Often, practical work experience is sufficient to qualify a person for a job in these fields, although college training may be required of persons without work experience.

One important group of these occupations is made up of inspectors and graders of agricultural products. Meat and poultry inspectors are employed by the U.S. Department of Agriculture and by many of the State departments of agriculture. They work under the supervision of veterinarians and inspect meat and poultry slaughtering, processing, and packaging operations to insure that proper sanitation is maintained throughout all phases of processing. They also inspect meat additives and make sure that processed meats are labeled correctly.

Agricultural commodity graders (D.O.T. 168.287) inspect samples of agricultural products to determine their quality and grade, and then issue grading certificates. They generally specialize in the inspection and grading of one particular commodity, such as eggs, vegetables, fresh fruits, dairy products, or grain. Grain inspectors inspect large quantities of grain for the presence of parasites, spoilage, or impurities, such as weeds. They also inspect ships for sanitation prior to loading for transport. Most grain inspectors are employed by Federal and State agencies; however, some also are employed by large buyers of grain, such as breweries.

Cotton classers (D.O.T. 469.387) use the standards for various grades of cotton established by the U.S. Department of Agriculture to classify cotton samples on the basis of color, fiber length, and presence of impurities. *Tobacco graders* (D.O.T. 529.687) examine the size, color, and texture of tobacco at auctions and certify the quality according to the Federal classification system. Some are employed at tobacco processing plants, and use less complex grading systems.

Persons with technical skills related to agriculture also are employed in a variety of positions to assist agricultural and biological research scientists in conducting experiments. Biolgical technicians work primarily in laboratories in which biological scientists are engaged in research, development, control, and testing of the chemical and biological properties of crops. Agricultural technicians generally work in fields and other experimental areas, such as greenhouses, barns, or growth houses. They assist agricultural scientists in experiments conducted under actual growing conditions.

Research technicians may perform a varity of duties. For example, they generally are responsible for preparing human subjects, animals, insects, plants, soils, and food samples for tests. Other responsibilities include setting up and adjusting instruments and equipment, conducting experiments, and tabulating and recording data. Additional duties, such as caring for laboratory animals, may be part of the job in some areas of specialization; technicians employed at Federal research facilities may specialize in microbiology, biochemistry, laboratory animal, animal science, plants, insects, or soils.

Other Jobs in Agribusiness. In addition to the many professional and technical jobs that require a knowledge of and training in agriculture, many industries that supply raw materials to farmers and process and

distribute agricultural products employ persons in urban as well as rural areas. While some of these people work in occupations that require some agriculture-related training, others work in jobs that are nonagricultural. Together with agricultural production, these industries make up an efficient food production and distribution system. This section will briefly discuss some of the career opportunities available in this system, in both rural and urban areas.

Many farmers are members of local and regional cooperatives. By joining cooperatives, farmers can buy many of their supplies, such as seeds, feeds, and fertilizers, as well as food and household goods, in large volumes and thus at lower wholesale prices. In addition, cooperatives provide marketing services so that individual farmers do not need to locate buyers for their products. Some also operate local stores. Local branches of cooperatives are found in nearly every rural community and in many small and medium-sized cities, although regional offices of large cooperatives often are located in large metropolitan areas.

Cooperatives employ persons with many different skills. Stock clerks and feed store managers are employed in local stores. Cooperatives also employ college-trained business managers to operate the cooperatives. Regional cooperatives employ sales representatives, wholesalers, and brokers to contact buyers for large grocery chains, food processing firms, and agricultural exporters to arrange contracts to sell agricultural products. They also employ purchasing agents and buyers to arrange volume purchases of seed, feed, fertilizers, and other supplies.

Farm equipment dealerships in agricultural areas employ persons in farm-related and nonfarm occupations. *Farm equipment dealers* (D.O.T. 277.358) must know the needs of farmers in their area and stock the latest equipment and machinery to meet those needs. Dealers and sales workers demonstrate and sell equipment, and farm equipment mechanics service and repair the machinery that is sold. Dealerships often have parts departments and thus employ parts sales workers. In addition, large dealerships often employ secretarial and other clerical employees.

The agricultural chemical industry, including manufacturing, distribution, and application, employs professional and technical workers with agricultural training. Chemists, agronomists, soil scientists, and other professional workers, along with research technicians, conduct research to develop new fertilizers and pesticides as well as to improve other chemicals for better agricultural uses. Many agricultural chemicals are sold by cooperatives; however, retail dealerships also are found in many small towns in farming areas. Retail dealerships employ store managers, stock clerks, sales workers, and clerical employees, and large dealerships often employ agricultural pilots and their assistants to apply chemicals.

These are just some of the many businesses that employ persons with agricultural training and also offer opportunities in nonagricultural occupations to people in farming areas. Over the past quarter-century the agricultural supply and distribution system has become more diverse, and now employs persons in most major industries, including the transportation, communications, and manufacturing industries.

Sources of Additional Information

Many of the occupations discussed in this section are described in more detail elsewhere in the *Handbook*.

Opportunities in Research. Additional information on research opportunities at land-grant colleges may be obtained from the dean of agriculture at the State land-grant college. Information on employment in the U.S. Department of Agriculture is available from the USDA recruitment representatives at land-grant colleges and from the Office of Personnel, U.S. Department of Agriculture, Washington, D.C. 20250.

The following publication will be valuable:

Careers in Agriculture and Natural Resources—Agriculture. American Association of Land-Grant Colleges and State Universities, Washington, D.C. Copies can be obtained free from State agricultural colleges.

Opportunities in Agricultural Finance. For information about employment opportunities in agricultural finance, contact:

Farm Credit Administration, Washington, D.C. 20578.

Farmers Home Administration, U.S. Department of Agriculture, Washington, D.C. 20250.

Agricultural Director, American Bankers Association, 90 Park Ave., New York, N.Y. 10016.

Opportunities with Cooperatives. Cooperatives in the individual communities are a good source of information on jobs either in their own organizations or in other cooperatives. Most States have a State council or association of cooperatives that can provide information on cooperative locations and some job information.

Opportunities as Vocational Agriculture Teachers. Prospective teachers should contact the head teacher trainer in agricultural education at the land-grant college or the State supervisor of agricultural education at the State department of public instruction in their respective States.

Also, many books written on the subject of jobs in agribusiness discuss opportunities in much greater detail and may be available in your local high school and public libraries.

MINING AND PETROLEUM

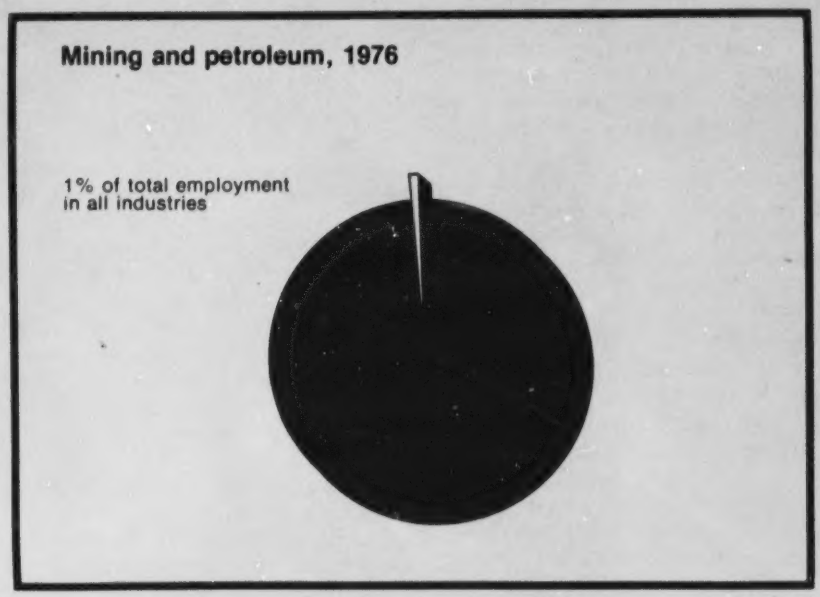
The mining and petroleum industry provides most of the basic raw materials and energy sources for industry and consumer use. Metal mines provide iron, copper, gold, and other ores. Quarrying and other nonmetallic mining yield many of the basic materials such as limestone and gravel for building schools, offices, homes, and highways. Nearly all of the Nation's energy for industrial and personal use comes from oil, gas, and coal. Few products from mines reach the consumer in their natural state; nearly all require further processing.

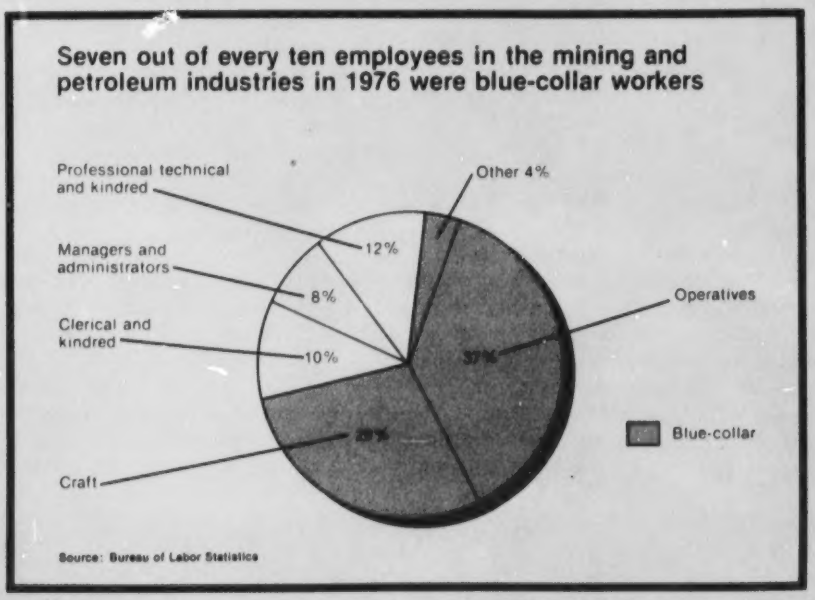
The mining and petroleum industry employed about 770,000 workers in 1976. Almost half of these worked in the exploration for and removal of crude petroleum and natural gas. Coal mining accounted for over one-fourth of the industry's workers. The remaining workers were in metal mining and quarrying and nonmetallic mineral mining.

As shown in the accompanying chart, blue-collar workers (craft workers and operatives) account for nearly seven-tenths of the industry's employment. Operatives is the largest occupational group in the industry. Included in the operative group are oil well drillers, mining machinery operators, and truck and tractor drivers. Skilled craft workers constitute the second largest occupational group. Mechanics and repairers maintain the complex equipment and machinery used in mining and in oil well drilling. Many operators of heavy equipment, such as power shovels and bulldozers, work in open pit mining. Large numbers of pumpers, gaugers, and engine workers hold jobs in the production and transportation of petroleum and natural gas. Supervisors of blue-collar workers also constitute an important part of the craft worker group.

The industry's white-collar employees are divided among three occupational groups—professional and technical, clerical, and managerial workers. Taken together, these groups compose the remaining three-tenths of the industry's employment.

Professional and technical workers are concentrated largely in petroleum and gas extraction. Most are en-





gineers, geologists, or technicians engaged in exploration and research. Two out of three clerical employees work in petroleum and gas extraction. Most are secretaries, office machine operators, and typists.

Employment in the mining and petroleum industry is expected to increase faster than the average for all industries through the mid-1980's, but different growth patterns are likely within the industry. Employment in coal mining and in petroleum and natural gas extraction should increase rapidly as the Nation strives to become self-sufficient in energy sources. Employment in metal mining also is expected to grow. Employment in quarrying and nonmetallic mining, on the other hand, is expected to decline as laborsaving equipment leads to higher output with fewer workers.

The statements that follow provide information on employment opportunities in the petroleum and natural gas extraction industry and the coal mining industry. More detailed information about many of the major occupations in the mining and petroleum industry also appears elsewhere in the *Handbook*.

COAL MINING

Nature of the Industry

Coal has played a vital role in the development of this Nation. Originally used only as a source of heat, coal grew rapidly as a source of power with the coming of the steam engine. By the beginning of the 20th century, coal had become vital, not only for heating homes and powering locomotives, but also as a source of energy for producing electric power and a necessary ingredient for making steel. Although coal has been largely replaced by other fuels for heating and transportation, it is used in products ranging from lipstick to chemicals, and most importantly as a source of electric power.

Coal usually is divided into two classes, bituminous and anthracite. Bituminous, or "soft" coal, is the most widely used and the most plentiful, and accounts for most coal production. Production of anthracite, or "hard" coal, on the other hand, is steadily declining due to dwindling reserves and difficulty of recovery. Other forms of coal, such as lignite and peat, are used in only limited amounts.

Most of the Nation's coal is mined in the Appalachian area that extends from Pennsylvania through Eastern Ohio, West Virginia, Virginia, Kentucky, Tennessee, and Alabama. Large amounts of coal also are mined in Indiana, Illinois, and in the Rocky Mountain States.

Types of Mines

Coal is either mined underground or extracted from the earth's surface. Underground mines employ most of the workers in the industry but produce less than half of all bituminous coal. Surface mining, a more productive type than underground mining, employs fewer miners to produce more coal.

The type of mine a company decides to open depends on the geological formation and the depth and location of the coal seam. Underground mines are used to reach coal that lies deep below the surface. A series of entries must be constructed so that air, miners, and equipment can reach the seam and coal can be carried out. Depending on the depth of the coal seam, the entry may be vertical (shaft mine), horizontal (drift mine), or at an angle (slope mine). (See chart.) Shaft mines are used to reach coal lying far below the surface. Drift and slope mines are usually not as far underground as shaft mines.

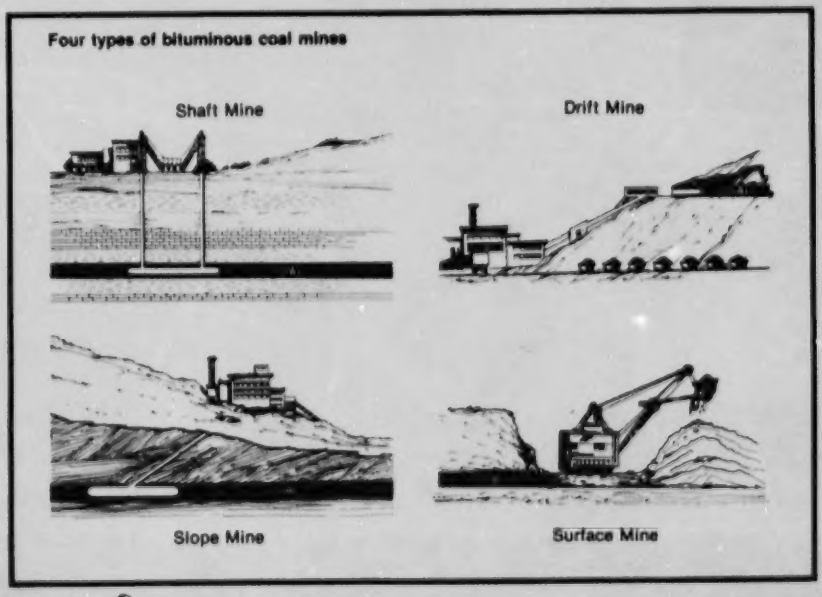
After the coal seam has been reached, nearly all underground mines are constructed the same way. Miners make a network of interconnecting tunnels so that the mine resembles a maze with passageways going off in predetermined directions, sometimes extending over many miles. As coal is removed, the tunnels become longer and longer. Throughout this process, a significant amount of coal (pillars) is left between the tunnels to support the roof. When miners reach the end of the company's property, they start working back toward the entrance, mining most of the remaining coal as they retreat. This is called retreat mining.

If the coal seam is not too far below ground, surface mining is practiced. Two types of surface mines are strip and auger. At strip mines, huge machines remove the earth and expose the coal. Auger mining is used to remove coal from extremely steep hillsides. A large auger (drill) bores into the hill and pulls the coal out.

Occupations in the Industry

In 1976 about 210,000 people worked in the bituminous coal and lignite mining industry. An additional 4,000 people were employed by companies producing anthracite coal. About 85 percent of all persons in these industries were production workers who mined and processed coal.

Mining jobs range from apprentice miners who usually act as helpers in several occupations to highly skilled and experienced miners who operate equipment worth several hundred



Most coal miners operate machines.

thousand dollars. Jobs available in a mine vary by type and method of mining.

Mining Occupations. Two basic methods of mining underground coal, conventional and continuous, account for 95 percent of total underground production. A third method, longwall, makes up most of the remaining production and is increasing in importance. The hand loading method is rarely used.

Conventional mining is the oldest method and requires the most workers and procedures. This type of mining, however, is rapidly being phased out. In conventional mining, the *cutting machine operator* (D.O.T. 930.883) uses a huge electric chain saw, with a cutter ranging in length from 6 to 15 feet, to cut a strip, or kerf, underneath the coal seam to control the direction of the coal as it falls after it has been blasted. Next the *drilling machine operator* (D.O.T. 930.782) drills holes into the coal where the *shot firer* (D.O.T. 931.281) places explosives. This work can be dangerous and must be timed very carefully. The shot firer, for example, must allow enough time for miners to leave the area before the blast.

After the blast, the *loading machine operator* (D.O.T. 932.883) scoops up and dumps the coal into small rubber-tired cars, which are run by the *shuttle car operator* (D.O.T. 932.883). Depending on the type of haulage system used, these cars take the coal to a conveyor belt for shipment to the main entry or to the surface, or onto mine cars that are transported on tracks to the surface.

The continuous mining method eliminates the drilling and blasting operations of conventional mining. The *continuous-mining machine operator* (D.O.T. 930.883) sits or lies in a cab and operates levers to cut or rip out the coal and load it directly onto a conveyor or shuttle cars.

Longwall mining is basically an extension of continuous mining. In this method, the *longwall machine operator* runs a huge machine with drums which shear and automatically load coal onto a conveyor. At the same time hydraulic jacks reinforce the roof. As the coal is cut and the face progresses, the jacks are hydraulically winched forward and the roof is allowed to cave behind.

Many other workers are required to run a safe and efficient underground mine. Before miners are allowed underground, the *fire boss* or preshift examiner (D.O.T. 939.387) inspects the work area for loose roof, dangerous gases, and adequate ventilation. If safety standards are not met, the fire boss will not allow the miners to enter. The *rock-dust machine operator* (D.O.T. 939.887) sprays limestone on the mine walls and ground to hold down dust since coal dust is extremely explosive and interferes with breathing.

The *roof bolter* (D.O.T. 930.883) operates a machine to install roof support bolts. This operation is extremely important because of the ever-present threat of roof cave-ins, the biggest cause of mine injuries. The *stopping builder* (D.O.T. 869.884) constructs doors, walls, or partitions in the passageways to force air through the tunnels to working areas. The supervisor, called a *face boss* (D.O.T. 939.138), is in charge of all operations at the work site where coal is actually mined.

Teamwork is very important in all types of underground mining. Miners are dependent upon each other when accidents occur for first aid and, if necessary, assistance in leaving the mine. A simple slip around a continuous mining machine, for example, could result in severed limbs.

Most surface miners operate the large machines that either remove the earth above the coal or dig and load the coal. The number of workers required to operate a surface mine depends on the types of machines used and the amount of overburden above the coal seam. The more overburden present, the greater the number of workers usually required.

In many strip mines, the overburden is first drilled and blasted. Then the *overburden stripping operator* or *dragline operator* (D.O.T. 859.883) scoops the earth away to expose the coal. Sometimes, a dragline is so huge and complicated to run that a team of persons is required to operate the levers.

Once the overburden is removed, the *coal loading machine operator* (D.O.T. 932.883) rips coal from the seam and loads the coal into trucks to be driven to the preparation plant. In auger mines, the *rotary auger operator* (D.O.T. 930.782) runs the machine that pulls the coal from sides of hills. *Tractor operators* (D.O.T. 929.883) drive bulldozers to move materials or pull out imbedded boulders or other objects. Helpers assist in operating these machines.

Other workers, not directly involved in the mining processes, work in and around coal mines. For example, skilled repairers, called *fitters* (D.O.T. 801.281), fix all types of mining machinery, and electricians check and install electrical wiring. Carpenters construct and maintain benches, bins, and stoppings. Many mechanics and electricians assemble, maintain, and repair the machines used in mines. While these workers

generally need the same skills as their counterparts in other industries, they require additional training to work under the unusual conditions in the mines. Mechanics, for example, may have to repair machines while on their knees with only their headlamp to illuminate the working area. Truckdrivers haul coal to railroad sidings or preparation plants and supplies to the mine.

Preparation Plant Occupations. Rocks and other impurities must be removed before coal is crushed, sized, or blended to meet the buyer's wishes. These processes take place at the preparation plant.

Many preparation plants are located next to the mine. The plant's size and number of employees vary by the amount of coal processed and degree of mechanization. Some plants have all controls centrally located and require few workers to oversee all washing, separating, and crushing operations. Among these workers is the *preparation plant central control operator* (D.O.T. 549.138) who oversees all operations. Plants that are not as mechanized, however, need workers at each step, such as the *wash box attendant* (D.O.T. 541.782) and *separation tender* (D.O.T. 934.885). Wash box attendants operate equipment that sizes and separates impurities from coal. The separation tender operates a device that further cleans coal with currents of water. Most jobs in the preparation plant are very repetitive.

Administrative, Professional, Clerical, and Technical Occupations. A wide range of administrative, professional, technical and clerical personnel work in the coal industry. At the top of the administrative group are executives who make all policy decisions. A staff of specialists, such as accountants, attorneys, and market researchers, supply legal, technical, and market information for decisionmaking. Clerical and secretarial workers assist the administrative staff.

A variety of engineering and scientific personnel work in the coal industry. *Mining engineers* (D.O.T. 010.081 and .187) examine coal seams for depth and purity, determine the type of mine to be built, and supervise the construction and maintenance of mines. *Mechanical engineers* (D.O.T. 007.081, .151, .168, and .187) oversee the installation of equipment, such as centralized heat and water systems, while *safety engineers* (D.O.T. 010.081) are in charge of all health and safety programs.

High-speed loading of rail cars at coal preperation plant.

The scientific staff conducts research on means to make coal a cleaner, more efficient, and more easily transportable energy source. For instance, many physicists, chemists, and geologists are studying feasible alternatives for converting coal into a gas or liquid.

Other technical personnel are required to assist scientists and engineers. For example, *surveyors* (D.O.T. 018.188) help map out the mining areas. Engineering and sci-

Mining engineer and supervisor discuss design of a mine.

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ence technicians may assist in research efforts.

Training, Other Qualifications, and Advancement

Most miners start out as helpers to experienced workers and learn skills on the job. Formal training, however, is becoming more important due to the growing use of technologically advanced machinery and mining methods. As a result, most companies supplement on-the-job training with formal programs and actively seek recent graduates of high school vocational programs in mining, or junior college or technical school programs in mine technology.

Mine technology programs are available in a few colleges throughout the country, mostly in coal mining areas. The programs lead either to a certificate in mine technology after 1 year, or an associate degree after 2 years. Courses cover areas such as mine ventilation, roof bolting, and machinery repairs. Prospective students do not need a high school education but must pass an entrance examination in basic math and English.

The type of formal training administered by coal companies varies. For example, some companies have training mines where skills are taught; others give classroom instruction for a few weeks before allowing workers into a mine. All miners working at mines covered by the United Mine Workers of America contract, however, must receive both preservice and annual retraining sessions from their employers. These programs include subjects such as machine operation, first aid, and health and safety regulations. The U.S. Mining Enforcement and Safety Administration also conducts classes on health, safety, and mining methods, and mine machinery manufacturers offer courses in machine operation and maintenance.

As miners gain more experience, they can move to higher paying jobs. When a vacancy occurs, an announcement is posted and all workers qualified may bid for the job. A mining machine operator's helper, for example, may become an operator. The position is filled on the basis of seniority and ability. A small number of miners advance to supervisory positions and, in some cases, to administrative jobs in the office.

Miners must be at least 18 years old and in good physical condition. A high school diploma is not required. All miners should be able to work in close areas and have quick reflexes in emergencies.

Requirements for scientific and engineering, administrative, and clerical jobs are similar to those in other industries. College graduates are preferred for jobs in advertising, personnel, accounting, and sales. For clerical and secretarial jobs, employers usually hire high school graduates who have training in stenography and typing.

Employment Outlook

Coal is expected to play an increasingly important role as a basic energy source. Rising demand for electric power coupled with greater emphasis on developing domestic energy supplies should result in accelerated coal production. The extent of growth in production, however, is uncertain. Oil, natural gas, and nuclear energy also are used to generate electricity, and the demand for coal will be determined, to some extent, by the price and availability of these fuels. Growth in production also depends on how quickly economical methods of coal gasification and liquification are developed. Environmental standards relating to strip mining and the use of high sulfur content coal, which causes air pollution, may also affect coal output. More coal, however, will be needed to make steel, chemicals, and other products.

Employment is expected to increase but the amount of growth will depend on the level of production, on the types of mines opened, and the mining methods and machinery used. In addition to openings due to growth, several thousand openings will occur each year as experienced miners retire, die, or transfer to other fields of work.

Earnings and Working Conditions

In 1976, union wage rates for miners ranged from $48.62 to $58.92 a day; workers in underground mines generally earned slightly more than those in surface mines or preparation plants. In comparison, production workers in manufacturing averaged $41.52 a day.

Because underground miners spend time traveling from the mine entrance to their working areas, they have a slightly longer day than surface miners. Those in surface occupations work a 7 1/4-hour shift (36-1/2-hour week), while underground miners work an 8-hour day (40-hour week).

Union miners receive 10 holidays and 14 days of paid vacation each year. As their length of service increases, they gain extra vacation days up to a total of 29. Union workers also receive benefits from a welfare and retirement fund, and workers suffering from pneumoconiosis (black lung) receive Federal aid.

Miners have unusual and harsh working conditions. Underground mines are damp, dark, noisy, and cold. At times, several inches of water may be on tunnel floors. Although mines have electric lights, many areas are illuminated only by the lights on the miners' caps. Workers in mines with very low roofs have to work on their hands and knees, backs, or stomachs in cramped areas.

Though safety conditions have improved considerably, miners must constantly be on guard for hazards. There also is the risk of developing pneumoconiosis from coal dust and silicosis from the rock dust generated by the drilling in the mines. Surface mines and preparation plants are usually less hazardous than underground mines.

Sources of Additional Information

For details about job opportunities in mining, contact individual coal companies. General information on mining occupations is available from:

United Mine Workers of America, 900 15th St. NW., Washington, D.C. 20005.

National Coal Association, 1130 17th St. NW., Washington, D.C. 20036.

Mining Enforcement and Safety Administration, Department of Interior, Washington, D.C. 20240.

OCCUPATIONS IN PETROLEUM AND NATURAL GAS PRODUCTION AND GAS PROCESSING

Nature and Location of the Industry

Petroleum is a natural fuel formed from the decay of plants and animals. Buried beneath the ground for millions of years under tremendous heat and pressure, this organic matter became petroleum, or what is usually called oil. Natural gas is formed by a similar process.

Oil and natural gas have assumed a position of such importance that they now furnish more than three-fourths of our energy needs. Oil and natural gas run our factories and transportation systems, heat our homes and places of work, and are basic raw materials for many products such as plastics, chemicals, medicines, fertilizers, and synthetic fibers. In spite of efforts to decrease our Nation's dependence on petroleum as a source of energy, petroleum and natural gas will continue to supply the major portion of our energy needs for many years to come.

Although U.S. production of oil and natural gas has been on the decline in recent years, most experts feel that there are large amounts of petroleum in this country that have not yet been discovered. Locating and extracting these petroleum reserves will make a significant contribution to the country's energy independence.

People with many different skills are needed to explore for oil and gas fields, drill new wells, improve existing wells, and process natural gas. In 1976, about 355,000 workers were employed in these activities. Firms that work on contract for oil companies employed many of these workers, and the major oil companies employed the rest. Occupations in oil refining are discussed in a separate chapter elsewhere in the *Handbook*.

Since oil and gas are difficult to find, exploration and drilling are key activities in the petroleum industry. After scientific studies indicate the possible presence of oil, the company selects a well site and installs a tower-like steel rig to support the drilling equipment. A hole is drilled deep into the earth until oil or gas is found or the company decides to write the effort off as a loss. Although a few large oil companies do their own drilling, most is done by contractors. There are hundreds of firms engaged in the search for and production of oil and natural gas.

When oil or gas is discovered, pipes, valves, tanks, and other equipment are installed to control the flow of these raw materials from the well. There were more than 600,000 wells in this country in 1976, and a large part of the petroleum industry's 250,000 production workers were needed to operate and maintain them.

Oil and gas are transported to refineries by pipeline, ship, railroad, barge, or truck. Many refineries are thousands of miles from oil fields, but gas processing plants usually are near the fields so that water, sulfur compounds, and other impurities can be removed before the liquid gas is piped to customers.

Although drilling for oil and gas is done in 35 States, about nine-tenths of the industry's workers are employed in 10 States. Texas leads in the number of oilfield jobs, followed by Louisiana, Oklahoma, California, Wyoming, Kansas, New Mexico, Colorado, Ohio, and Illinois. Thousands of additional Americans are employed by oil companies overseas, mostly in the Middle East, Africa, Western Europe, South America, and in Indonesia and other Far Eastern countries.

Occupations in the Industry

Workers with a wide range of education and skills are needed to find oil and gas and to drill, operate, and maintain wells and process natural gas.

Exploration. Exploring for oil is the first step in petroleum production. Small crews of specialized workers search for geologic formations that are likely to contain oil. Exploration parties study the surface and subsurface of the earth in order to locate places where oil might be concentrated in underground rock formations. They seek clues to the possible existence of oil by examining types of rock formations on and under the earth's surface. Besides detailed ground surveys, aerial exploration and magnetic surveys also are used for a broad picture of the area.

Several methods are used to determine the nature and location of underground rock formations. A technique called seismic prospecting is widely used to map underground rock formations. In this technique, a large shock is set off at the earth's surface. This can be caused by explosives or, more commonly, by a "thumper," which is a heavy weight dropped on the ground. The time it takes for the sound waves to reach the rock formations and return to the surface is carefully measured to locate the depth and position of underground features. Subsurface evidence also is collected by boring and bringing up core samples of the rock, clay, and sand that form the layers of the earth. Similar techniques are used to explore offshore areas.

Exploration parties are led by a *petroleum geologist* (D.O.T. 024.081), who analyzes and interprets the information gathered by the party. In addition to the petroleum geologist, exploration parties may include other geology specialists: *Paleontologists* (D.O.T. 024.081) study fossil remains in the earth to locate oil-bearing layers of rock; *mineralogists* (D.O.T. 024.081) study physical and chemical properties of mineral and rock samples; *stratigraphers* (D.O.T. 024.081) determine the rock layers most likely to contain oil and natural gas; *photogeologists*

(D.O.T. 024.081) examine and interpret aerial photographs of land surfaces; and *petrologists* (D.O.T. 024.081) investigate the history of the formation of the earth's crust. Often a geologist must have knowledge of some or all of these specialties since not all exploration parties include all these specialists. Exploration parties also include *drafters* (D.O.T. 010.281) and *surveyors* (D.O.T. 018.188), who assist in surveying and mapping operations.

Many geologists also work in district offices of oil companies or exploration firms where they prepare and study geological maps. They also study samples from test drilling to find any clues to oil.

A *geophysicist* (D.O.T. 024.081) usually leads a seismic prospecting crew that may include: *prospecting computers* (D.O.T. 010.288), who perform the calculations and prepare maps from the information recorded by the seismograph, which is an instrument that measures the earth's vibrations; and *observers* (D.O.T. 010.168), who operate and maintain electronic seismic equipment. Other workers whose activities are related to exploration are: *scouts* (D.O.T. 010.288), who investigate the drilling, exploration, and leasing activities of other companies in order to identify promising areas to explore and lease; and *lease buyers* (D.O.T. 191.118), who make the necessary business arrangements with landowners or with owners of mineral rights to obtain the right to use the land.

Drilling. Exploration methods are used to find places where the presence of oil is likely but only drilling can prove the presence of oil. Overall planning and supervision of drilling usually are the responsibilities of the petroleum engineer.

Wells are almost always started in the same way. *Rig builders* (D.O.T. 869.884) and a crew of *rig-builder helpers* (D.O.T. 869.887) install a portable drilling rig to support the machinery and equipment that raises and lowers the drilling tools. Rotary drilling is the normal way of drilling a well. A revolving bit bores a hole in the ground by chipping and cutting rock. The bit is attached to a length of revolving pipe. As the bit cuts deeper into the earth, more pipe is added. Drilling pipe is hollow and runs the entire depth of the well. A stream of drilling mud is continuously pumped into the hollow pipe and comes out through holes in the drill bit. This mud is a mixture of clay, chemicals, and water. Its purpose is to cool the drill bit, plaster the walls of the hole to prevent cave-ins, and carry crushed rock to the surface so that drilling is continuous until the bit wears out. When a new bit is needed, all of the pipe must be pulled up out of the hole, a section at a time, a new bit placed on the end of the pipe, and the pipe returned to the hole.

The *tool pusher* or *drilling supervisor* (D.O.T. 930.130) supervises one or more drilling rigs and supplies materials and equipment to rig crews.

A typical rotary drilling crew consists of four or five workers: driller, derrick operator, engine operator, and one or two helpers. Because drilling rigs are operated 24 hours a day, 7 days a week, several crews are needed for each rig.

The *rotary driller* (D.O.T. 930.782) supervises the crew and operates machinery that controls drilling speed and pressure, and records operations. The *rotary rig engine operator* (D.O.T. 950.782) is in charge of engines that provide the power for drilling and hoisting. The *derrick operator* (D.O.T. 930.782), who is second in charge, works on a small platform high on the rig to help run pipe in and out of the well hole, and operates the pumps that circulate mud through the pipe. *Rotary drill helpers* (D.O.T. 930.844), also known as roughnecks, guide the lower end of the pipe to and from the well opening and connect and disconnect pipe joints and drill bits.

Roustabouts (D.O.T. 869.884) or general laborers, though not considered part of a drilling crew, do general oilfield maintenance and construction work, such as cleaning tanks and building roads.

Well Operation and Maintenance. When oil is found, the drill pipe and bit are pulled from the well, and metal pipe known as casing is lowered into the hole and cemented in place. The upper ends of the casing are fastened to a system of valves called a "Christmas tree." Pressure in the well forces crude oil and gas to the surface, through the Christmas tree, and into gas traps and storage tanks. If natural pressure is not great enough to force the oil to the surface, pumps are used.

Petroleum engineers (D.O.T. 010.081) generally plan and supervise well operation and maintenance. To prevent waste, they decide the rate of oil flow and anticipate performance of oil reservoirs by analyzing information such as pressure readings from the well. Engineers are increasingly using computers for analytical work. Some engineers specialize in areas such as overcoming effects of corrosion on well casing, in the selection and design of production equipment and processes, or in the prevention of pollution. Some companies hire engineer aides to make tests, keep records, post maps, and otherwise assist engineers.

Pumpers (D.O.T. 914.782) and their helpers operate and maintain motors, pumps, and other surface equipment to force oil from wells. Their chief duty is to regulate the flow of oil according to a schedule set up by the petroleum engineer and production supervisor. Generally, a pumper operates a group of wells. *Switchers* work in fields where oil flows under natural pressure and does not require pumping. Pumpers open and close valves to regulate the oil flow from wells to tanks or into pipelines. *Gaugers* (D.O.T. 914.381) measure and record the flow and take samples to check quality. *Treaters* (D.O.T. 541.782) test the oil for water and sediment and remove these impurities by opening a drain at the tank's base or by using special chemical or electrical equipment. In some fields, pumping, switching, gauging, and treating operations are automatic.

Many skilled workers are employed in maintenance operations. Welders, pipefitters, electricians, and machinists repair and install pumps, gauges, piping, and other equipment.

Natural Gas Processing. Most gas processing workers are operators. The *dehydration-plant operator* (D.O.T. 541.782) tends an automatically controlled treating unit which removes water and other impurities from natural gas. The *gas-plant operator* (D.O.T. 953.380) tends compressors that raise the pressure of the gas for transmission in the pipelines. The *gas-compressor operator* (D.O.T. 950.782) assists either of these two employees.

Many workers in the larger natural gas processing plants are employed in maintenance activities. These include instrument repairers, electricians, welders, and laborers.

In numerous smaller natural gas plants, workers combine skills, usually of operator and maintenance worker. Many small plants are so highly automated they are virtually unattended. They are checked at periodic intervals by maintenance workers or operators, or they are checked continuously by instruments that automatically report problems and shut down the plant if an emergency develops.

Other Oilfield Services. Companies that offer services on a contract basis provide another important source of employment. Among these employees are skilled workers such as *cementers* (D.O.T. 930.281), who mix and pump cement into the space between the steel casing and the well walls to prevent cave-ins; *acidizers* (D.O.T. 930.782), who force acid into the bottom of the well to increase the flow of oil; *perforator operators* (D.O.T. 931.782), who use subsurface "guns"to pierce holes in drill pipes or casings to make openings for oil to flow through; *sample-taker operators* (D.O.T. 931.781), who take samples of soil and rock formations from wells to help geologists determine the presence of oil; and *well pullers* (D.O.T. 930.883), who remove pipes, pumps, and other subsurface devices from wells for cleaning, repairing, or salvaging.

Offshore Operations. Most exploration, drilling, and producing activities are on land but an increasing amount of this work is done offshore, particularly in the Gulf of Mexico off the coasts of Louisiana and Texas. Additional offshore work is being done off the west coast of the United States. Some drilling is expected to take place soon off the east coast. Some wells have been drilled over 100 miles from shore and in water more than 1,000 feet deep. These offshore operations require the same type of drilling crews as are employed on land operations. In addition, offshore operations require radio operators, cooks, ship's officers and sailors, and pilots for work on drilling platforms, crewboats, barges, and helicopters.

(Detailed discussions of professional, technical, mechanical, and other occupations found not only in the petroleum and natural gas production industry, but in other industries as well, are given elsewhere in the *Handbook* in the sections covering individual occupations.)

Training, Other Qualifications,and Advancement

Most workers in nonprofessional jobs with an exploration crew begin as helpers and advance into one of the specialized jobs. Their training may vary from several months to several years. New workers usually are hired in the field by the crew chief or by local company representatives. College students majoring in physical or earth sciences or in engineering may work part time or summers with exploration crews, and get full-time jobs after graduation.

Members of drilling crews usually begin as roughnecks. The major qualifications needed are mechanical ability and adequate physical strength and stamina. Previous experience is desirable but not necessary. As they acquire experience, they may advance to more skilled jobs. For example, a worker hired as a roughneck may advance to derrick operator and, after several years, become a driller. A driller can advance to the job of tool pusher in charge of one or more drilling rigs.

Companies generally hire people who live near wells for well operation and maintenance jobs. They prefer applicants who have mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous than drilling and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs. New workers may start as roustabouts and advance to jobs as switchers, gaugers, or pumpers. Training usually is acquired on the job; at least 2 years of experience are needed to become an all-round pumper.

For scientists, such as geologists and geophysicists, college training with at least a bachelor's degree is required. The preferred educational qualification for a petroleum engineer is a degree in engineering with specialization in courses on the petroleum industry. However, college graduates having degrees in chemical, mining, civil or mechanical engineering, or in geology, geophysics, or other related sciences often are hired for petroleum engineering jobs. Petroleum engineering aides include people with 2-year technical degrees as well as former roustabouts or pumpers who have been promoted.

Scientists and engineers usually start at junior levels; after several years of experience they can advance to managerial or administrative jobs. Scientists and engineers who have research ability, particularly those with advanced degrees, may transfer to research or consulting work.

Information on training, qualifications, and advancement in natural gas processing plants is similar to that for petroleum refining. A statement on petroleum refining can be found elsewhere in the *Handbook*.

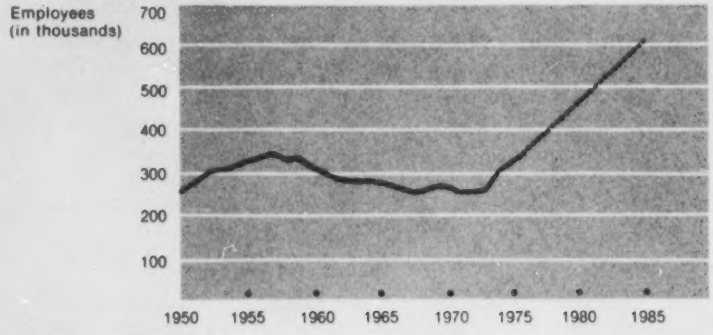
Employment Outlook

Employment in petroleum and natural gas production is expected to increase faster than the average for all industries through the mid-1980's. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or leave the industry for other reasons.

Greatly increased prices for crude oil and natural gas and a national policy to move toward energy self-sufficiency are expected to provide the incentives for the industry to expand rapidly. Growth will be con-

Very rapid growth in the oil and gas extraction industry will result from expansion of exploration and drilling activities

Wage and salary workers in oil and gas extraction, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

centrated in exploration and drilling, and many more workers will be needed in most occupations associated with these activities. Opportunities should be particularly good in offshore drilling.

Earnings and Working Conditions

In 1976, nonsupervisory employees in oil and gas extraction averaged $5.70 an hour. In comparison, the average for all nonsupervisory workers in private industry, except farming, was $4.83 an hour. Earnings usually are higher in offshore operations than in land operations.

Most oilfield jobs involve rugged outdoor work in all kinds of weather. They often are in remote areas in settings as varied as a western desert, the Arctic Circle, or the Gulf of Mexico. Physical strength and stamina are important because the work involves standing most of the time, lifting moderately heavy objects, and climbing and stooping to work with power tools and handtools that often are oily and dirty.

Drilling employees may expect to move from place to place since their work in a particular field may be completed in a few months. Exploration field personnel may be required to move even more frequently. They may be away from home for weeks or months at a time. Well operation and maintenance workers and natural gas processing workers usually remain in the same location for long periods.

On land, drilling crews usually work 7 days, 8 hours a day, and then have a few days off. In offshore operations, they may work 7 days, 12 hours a day, and then have 7 days off. If the well is far from the coast, they live on the drilling rig or on ships anchored nearby. Most workers in well operations and maintenance and natural gas processing work 8 hours a day, 5 days a week.

Sources of Additional Information

Further information about jobs in the petroleum industry may be available from the personnel offices of individual oil companies. For information on scientific and technical jobs, write to:

American Association of Petroleum Geologists, P.O. Box 979, Tulsa, Okla. 74101.

Society of Petroleum Engineers of AIME, 6200 N. Central Expressway, Dallas, Tex. 75206.

American Geological Institute, 5205 Leesburg Pike, Falls Church, Va. 22041.

CONSTRUCTION

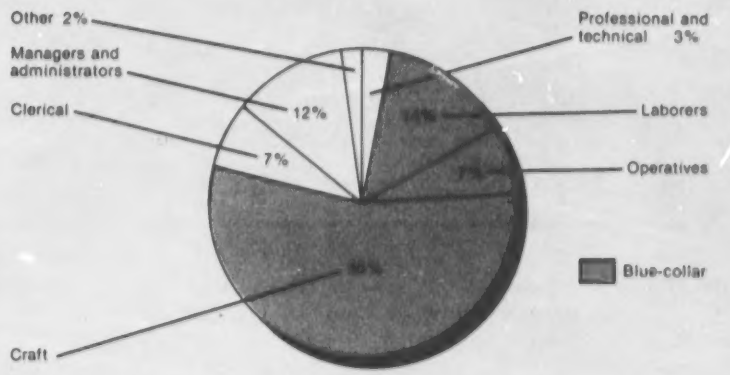
The activities of the construction industry touch nearly every aspect of our daily lives. The houses and apartments in which we live; the factories, offices, and schools in which we work; and the roads on which we travel are examples of some of the products of this industry. The industry includes not only new construction, but also additions, alterations, and repairs to existing structures.

In 1976, about 3.6 million people worked in contract construction. An additional 1.4 million workers not in contract construction are estimated to be either self-employed—mostly owners of small building firms—or are Federal, State, or local government employees who build and maintain our Nation's vast highway systems.

The contract construction industry is divided into three major segments. About half of the jobholders work for electrical, air-conditioning, plumbing, and other special trade contractors. Almost one-third work for the general building contractors that do most residential, commercial, and industrial construction. The remaining one-fifth build dams, bridges, roads, and similar heavy construction projects.

As illustrated in the accompanying chart, craft and kindred workers account for 55 percent of the total employment in this industry—a much higher proportion than in any other major industry. Some examples of craft workers are carpenters, painters, plumbers, and bricklayers. Laborers are the next largest occupational group and account for 14 percent of employment. They provide materials, scaffolding, and general assistance to skilled workers. Semiskilled workers (operatives), such as truckdrivers and welders, represent about 8 percent of the industry's work force. Managers and administrators—mostly self-em-

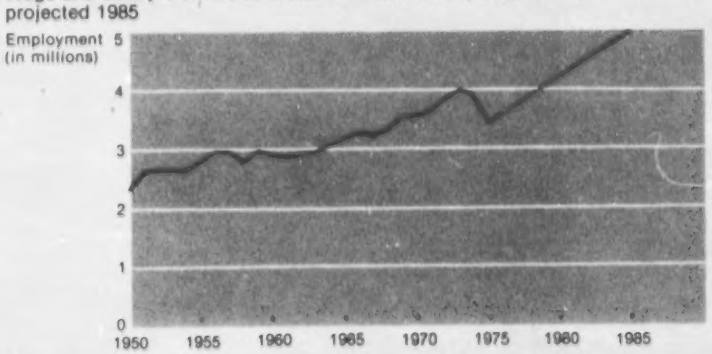
Four out of every five persons employed in contract construction in 1976 were blue-collar workers



Source: Bureau of Labor Statistics

Although employment in the construction industry fluctuates with the state of the economy, the trend through 1985 shows growth

Wage and salary workers in contract construction, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

ployed—account for about 12 percent of employment. Clerical workers, largely typists, secretaries, and office machine operators, constitute another 7 percent of the industry's employment. Professional and technical workers, mostly engineers and engineering technicians, drafters, and surveyors, make up the remaining 3 percent of the work force.

Construction industry employment is expected to rise faster than the average for all industries through the mid-1980's, as population and income growth create a demand for more houses, schools, factories, and other buildings. However, employment may fluctuate from year to year because construction activity is sensitive to changes in economic conditions.

Construction trade workers in the industry earned an average of $7.68 per hour in 1976. This was about 50 percent more than the hourly average of production or nonsupervisory workers in private industry, except farming. Yearly earnings of construction workers generally are lower than the hourly rate would indicate, however, because the annual number of hours they work can be adversely affected by poor weather and fluctuations in construction activity.

Contract construction is the major source of employment for skilled craft workers such as bricklayers, painters, and carpenters. For information on these and other construction crafts, see the chapter on construction occupations elsewhere in the *Handbook*.

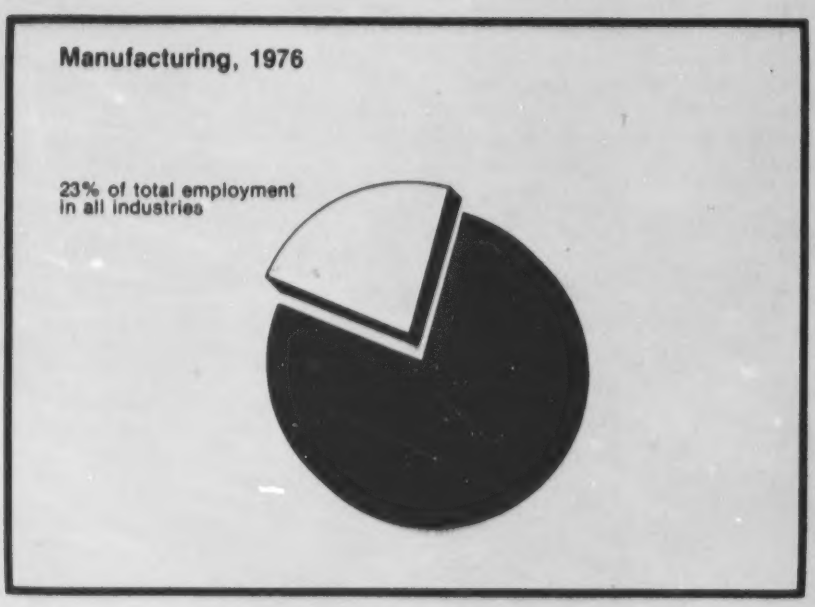
MANUFACTURING

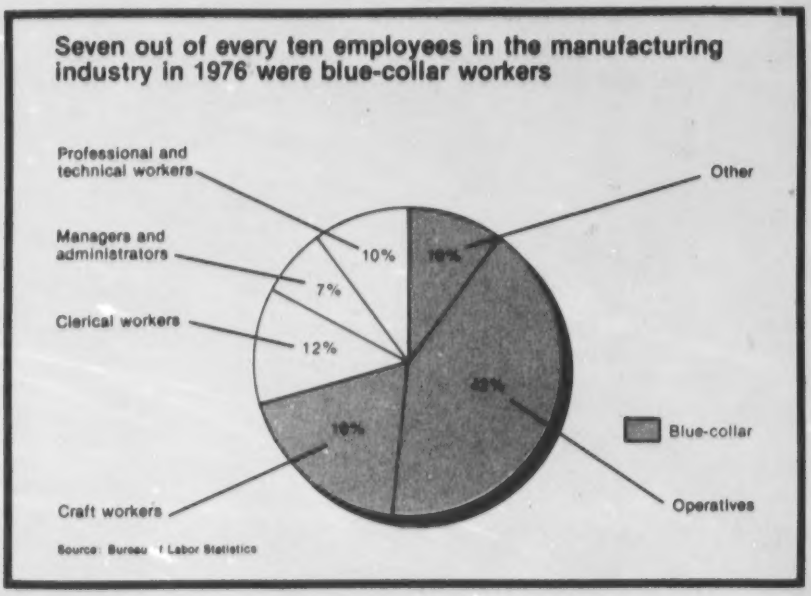
Our Nation's economy is composed of nine major industry divisions that provide us with a wide variety of goods and services. These nine divisions are agriculture; mining; contract construction; manufacturing; transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government. In terms of the impact it has on our lives, manufacturing may well be the most important.

Almost everything we use in our work, leisure, and even in our sleep is a product of a manufacturing industry. Factories produce goods that range in complexity from simple plastic toys to intricate electronic computers, and in size from miniature electronic components to gigantic aircraft carriers. Workers in the many diverse manufacturing industries process foods and chemicals, print books and newspapers, spin textiles and weave them, make clothing and shoes, and produce the thousands of other products needed for our personal and national welfare.

In terms of employment, manufacturing, with almost 20 million workers in 1976, was the largest of the major industry divisions. About three-fifths of all manufacturing employees worked in plants that produced durable goods, such as steel, machinery, automobiles, and household appliances. The rest worked in plants that produced nondurable goods, such as processed food, clothing, and chemicals.

The occupational distribution of the major industry divisions differs according to each industry's particular needs. Industries such as wholesale and retail trade, for example, require large numbers of sales and service workers while the mining industry needs very few workers in these occupational groups. Like all





industries, manufacturing has its own unique occupational composition.

As illustrated in the accompanying table, blue-collar workers (craft workers, operatives, and laborers) make up about two-thirds of manufacturing employment. Operatives, who are needed to run the machines used to manufacture goods, account for over four-tenths of total employment in manufacturing. Many are spinners and weavers, sewing machine operators, machine tool operators and welders, or operators of the specialized processing equipment used in the food, chemical, paper, and petroleum industries.

Craft and kindred workers make up the next largest group and account for nearly one-fifth of employment in manufacturing. Many of these skilled workers help support the production processes by installing and maintaining the wide assortment of machinery and equipment required in all factories. Others are directly involved in production. Machinists, for example, are especially important in the metalworking industries, as are skilled inspectors and assemblers. In the printing and publishing industries, compositors, typesetters, photoengravers, lithographers, and pressworkers make up a large share of the work force. The craft group also includes supervisors of blue-collar workers.

Laborers account for about 1 out of every 20 jobs in manufacturing. Many of these workers help support the production process by moving and storing raw materials and by helping more skilled workers prepare equipment for use.

White-collar workers (professional, managerial, clerical, and sales workers) account for nearly one-third of employment in manufacturing establishments. Clerical workers, such as secretaries and office machine operators, are the largest white-collar group, holding about 1 out of every 8 jobs in the manufacturing sector. Clerical workers help handle the necessary paperwork including payroll accounting, billing, and other paperwork that is found in all types of business activity.

Professional, technical, and kindred workers account for about 1 out of every 10 jobs in manufacturing establishments. Engineers, scientists, and technicians represent a large share of the professional workers. These highly trained workers include not only those who oversee and guide the production processes, but also those who carry out the extensive research and development activities needed in the aerospace, electronics, chemical, petroleum, and other industries.

Managers and administrators account for about 1 out of every 16 workers. In addition to the managers who run the factories, many workers in this category are responsible for buying the numerous goods and raw materials used in manufacturing.

Sales workers constitute a very small part of employment in manufacturing, only about 1 out of every 50 workers, but they perform the vital function of selling the goods made in the factories.

Population growth, rising personal income, and expanding business activity will create a substantial increase in the demand for manufactured products through the mid-1980's. Employment in manufacturing, however, is expected to increase at a slower pace than production as technological advances and improvements in manufacturing methods increase the amount of goods each worker can produce.

The employment outlook for individual manufacturing industries, however, will vary widely. Employment in the industries manufacturing rubber and miscellaneous plastic products, medical and dental instruments, and computers and peripheral equipment, for example, should increase faster than the average. While employment in most manufacturing industries is expected to increase through the mid-1980's, employment in some—including tobacco, food, and radio and television sets—is expected to decline.

The chapters that follow provide information on employment opportunities in several of the manufacturing industries. More detailed information about occupations found in manufacturing as well as in many other industries appears elsewhere in the *Handbook*. (See index in the back of the book.)

OCCUPATIONS IN AIRCRAFT, MISSILE, AND SPACECRAFT MANUFACTURING

Firms that manufacture and assemble aircraft, missiles, and spacecraft make up what is known as the "aerospace" industry. In 1976, more than 700,000 people worked in the industry—nearly 500,000 in the manufacture and assembly of complete aircraft, aircraft engines, propellers, and auxiliary parts and equipment; 85,000 in the manufacture of missiles and spacecraft; and 160,000 in companies that make electronic equipment and instruments for aircraft, missiles, and spacecraft. Thousands of workers in other industries produced parts, machinery, and equipment used in the manufacture of aerospace vehicles. Also, thousands of Federal workers were engaged in aerospace-related work, since the Government is a major purchaser of the industry's products. These workers were primarily employed in the National Aeronautics and Space Administration (NASA) and the Department of Defense.

Although aerospace jobs exist in almost every State, the largest concentration is in California. Other States with large numbers of aerospace jobs include New York, Washington, Connecticut, Texas, and Florida.

Nature of the Industry

All aircraft, missiles, and spacecraft have the same basic components—a frame, an engine, and a guidance and control system. Ballistic missiles and spacecraft travel into space at speeds many times faster than sound, while aircraft fly in the earth's atmosphere at much slower rates. Missiles are powered by either jet or rocket engines; spacecraft are rocket-powered only. Aircraft are powered by piston, jet, or rocket engines.

Aircraft vary from small personal or business planes that do not cost much more than an automobile to multi-million dollar jumbo transports and supersonic fighters. In dollar value most aircraft production is for military use although the value of planes made for commercial and private use has been increasing.

Missiles are for military use and generally carry destructive warheads. While some are capable of traveling only a few miles, such as those that support ground troops and defend against low-flying aircraft, others have intercontinental ranges of 7,000 miles or more. Some missiles are launched from land; others from aircraft, submarines, or ships.

Most of the Nation's spacecraft are built for NASA and the Department of Defense to explore outer space or to monitor conditions within the earth's atmosphere. On manned flights, a cabin capsule carries the astronauts. Some spacecraft probe the space environment and then fall back to earth, while others, such as those that monitor weather conditions, enter into earth orbit and become artificial satellites. Still others orbit or land on the moon or go to other planets. All spacecraft carry instruments that record and transmit scientific data to earth stations.

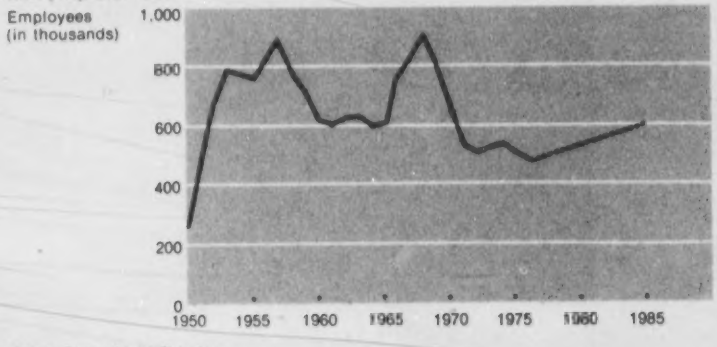
Major aircraft, missile, and spacecraft firms contract with government or private business to produce an aerospace vehicle. As a contractor, the firm is responsible for managing and coordinating the entire project. This involves design, production, assembly, and inspection of the vehicle.

Although aircraft, missile, and spacecraft manufacturers generally make many components of a craft and do final assembly work themselves, thousands of subcontractors are involved in the production of parts or supplies the original firm cannot produce, such as bearings, rocket fuels, or special lubricants. Other subcontractors produce subassemblies such as communication or guidance equipment or jet engines. Some of these firms depend on still other subcontractors to supply parts for their subassemblies.

In producing an aerospace vehicle, the contractor's engineering department first prepares design drawings and specifications, usually after long

Employment in aircraft and parts manufacturing increases sharply in times of accelerated defense spending

Wage and salary workers in aircraft and parts manufacturing, 1950-76 and projectd 1985



Source: Bureau of Labor Statistics

Operator of braiding machine for aircraft ducts.

consultations with the purchaser. Then, the production department works on details for machines, materials, and operations needed to manufacture the vehicle. Often, special tools and machines must be designed and produced in order to make parts or to assemble the aerospace vehicle. This is especially true when a firm is developing an experimental or ultra-sophisticated vehicle requiring specially designed parts or assemblies.

Once parts and components are developed, they are tested and inspected many times before being assembled. If the tests prove satisfactory, assembly of the entire craft may begin. Finally, the finished vehicle is checked out by a team of mechanics, or flight-tested if it is an aircraft, before it is delivered.

Occupations in the Industry

Because of the complex and changing nature of aerospace technology, firms need workers with many different types of skills. The types of workers required also will depend on the specific function of an aerospace plant. For example, a plant primarily engaged in research and development or in producing experimental prototypes requires many more scientists and engineers than a firm producing large quantities of parts for aircraft.

Major jobs in aerospace manufacturing are described under three main categories: Professional and technical; administrative, clerical, and related occupations; and plant occupations. Many of these jobs are in other industries as well and are discussed in greater detail elsewhere in the *Handbook*.

Professional and Technical Occupations. Research and development (R&D) are vital to the aerospace industry. The pace of discovery in aerospace technology is so rapid, in fact, that much equipment becomes obsolete while still in an experimental stage or soon after being put into production. Today, research is conducted in many areas such as developing vehicles with greater speeds, ranges, and reliability; engines with more power; and more advanced sources of rocket propulsion such as nuclear and electric energy. Metals and plastics also are continually being developed for wider capabilities, as are electronic guidance and communication system

Emphasis on R&D makes the aerospace industry an important source of jobs for technical personnel. In 1976, about one-fourth of all employees were engineers, scientists, and technicians, a considerably higher proportion than in most other manufacturing industries.

Engineers, scientists, and technicians work together in developing designs for aircraft, missiles, and spacecraft. Scientists often do research on how materials withstand certain conditions, such as intense heat or velocity, or create new materials that are needed. Engineers apply the information obtained by scientists to develop new designs. Before an engineering department approves a design for production, it conducts tests to determine which designs can best withstand expected operating conditions. A scale model is made from a preliminary drawing and is tested in wind, temperature, and shock tunnels and other testing areas that simulate actual flight conditions. Next, a full-sized experimental model, or prototype, is thoroughly tested in the air and on the ground. The design is modified many times during this process until the test results are satisfactory. Then, actual

production may begin. Even after production has started, however, further changes often are made.

Due to the wide range of R&D projects, many types of engineers and scientists work in the aerospace industry. Aerospace, chemical, electrical, electronic, industrial, and mechanical engineers are among the larger groups of engineering specialists needed in this industry. Scientists in the industry include physicists, mathematicians, chemists, metallurgists, and astronomers. These engineers and scientists work in a wide and varied range of applied fields such as materials and structures, energy and power systems, and space sciences.

Among the many types of workers assisting scientists and engineers are drafters and engineering and science technicians. Drafters use tools such as compasses and protractors to prepare detailed drawings of a design based on rough sketches and calculations made by engineers. The drawing details the exact measurement of every part, specifications for materials to be used, and the procedures to be followed in producing the object.

Engineering and science technicians assist scientists and engineers in R&D. They usually operate complex machinery and equipment to carry out tests under the supervision of a scientist or engineer.

Other workers who help scientists and engineers include *production planners* (D.O.T. 012.188), who plan the layout of machinery, movement of materials, and sequence of operations for efficient manufacturing processes; and *technical illustrators* (D.O.T. 017.281), who help prepare manuals and other technical literature describing the operation and maintenance of aerospace products.

Administrative, Clerical, and Related Occupations. Managerial and administrative jobs generally are comparable to similar jobs in other industries, except that in the aerospace industry these positions are often filled by people with technical backgrounds in engineering or science. These positions include executives responsible for the direction and supervision of research and production, and officials in departments such as sales, purchasing, accounting, and industrial relations. Many thousands of clerks, secretaries, computer personnel, and other office personnel work in aerospace firms.

Plant Occupations. About one-half of all workers in the aerospace industry have plant- or production-related jobs. Plant jobs can be classified in the following groups: Sheet-metal work; machining and tool fabrication; other metal processing; assembly and installation; inspecting and testing; flight checkout; and materials handling, maintenance, and custodial.

Sheet-Metal Occupations. Following blueprints and other engineering information, *sheet-metal workers* (D.O.T. 804.281) shape complicated parts from sheets of thin metal by hand or machine. When shaping parts by hand, these workers either pound them with mallets or bend, cut, or punch them with handtools. Machine methods use power hammers and presses, saws, tube benders, and drill presses. This work requires much precision since a part must fit perfectly.

Less skilled workers usually specialize in the use of a single machine to fabricate parts required in large numbers. Some of these workers are *punch press operators* (D.O.T. 615.782), *power hammer operators* (D.O.T. 617.782) and *power shear operators* (D.O.T. 615.782 and .885).

Machining and Tool Fabrication Occupations. Machining and tool fabrication workers use a wide variety of machines and handtools to make metal parts of machines or other products. Many of these workers are in engine and propeller plants, which are basically metal-working establishments; fewer are required in plants that assemble complete aerospace vehicles.

The most skilled machinists are the *all-round machinists* (D.O.T. 600.280 and .281) who plan the work and set up and operate several types of machine tools. They perform highly varied, nonrepetitive machining operations, frequently producing parts for experimental and prototype vehicles.

Machine tool operators (D.O.T. 609.885) produce metal parts in large volume. They generally operate a single type of machine tool such as a lathe, drill press, or milling machine. Skilled operators set up work on a machine and handle more difficult and varied jobs. Less skilled operators do more repetitive work.

Other machining and tool fabrication workers produce parts needed for the manufacture of aerospace vehicles. On the basis of information received from an engineering department, *jig and fixture builders* (D.O.T. 693.280) build jigs—metal devices used as guides for tools. *Tool-and-die makers* (D.O.T. 601.280) make the cutting tools and fixtures used in machine tool operations, and the dies used in forging and punch press work.

Other Metal Processing Occupations. Some of the many other metalworking occupations are *tube benders* (D.O.T. 709.884), who form tubings used for oil, fuel, hydraulic, and electrical conduit lines; and *riveters* (D.O.T. 800.884) and *welders* (D.O.T. 810.782 and .884; 811.782 and .884; 812.884 and 813.380 and .885), who use mechanical and electrical devices to join fabricated parts. Metalworking jobs also are located in foundry plants where workers produce castings by pouring molten metal into molds.

Many workers chemically treat and heat-treat aircraft, missile, and spacecraft parts during their manufacture to clean, change, or protect their surfaces or structural condition. For example, *heat treaters* (D.O.T. 504.782) heat sheet-metal parts to keep the metal soft and malleable for metal-shaping work *Painters* (D.O.T. 845.781) and *platers* (D.O.T. 500.380) either paint or plate surfaces.

Assembly and Installation Occupations. Practically all plants in the aerospace industry employ assembly and installation workers. Some assemble engines, electronic equipment, and auxiliary components, but most assemble major subassemblies or install major compon or spacecraft. In an aircraft, for example, this work involves joining wings and tails to the fuselage and installing the en-

gine and auxiliary equipment such as the fuel system and flight controls. Assemblers rivet, drill, bolt, weld and solder parts together.

Many assemblers are skilled mechanics and installers who read blueprints and interpret other engineering specifications as they take apart, inspect, and install complex mechanical and electronic assemblies. Often, assembly work is not as repetitive as in other industries. An assembler in an aerospace plant, for example, may spend a few months assembling a huge 747 aircraft and then work on the assembly of a small, two-seater plane. Some assemblers, such as *final assemblers* (D.O.T. 806.781) of complete aircraft and *missile or rocket assembly mechanics* (D.O.T. 625.281), do general assembly work, and often work on experimental, prototype, or special craft.

Other skilled assemblers who work in plants that produce relatively large numbers of aircraft and missiles rather than a few experimental types, however, often specialize in the assembly of one specific part of a space vehicle. Assemblers also specialize in systems such as electrical wiring, heating, and plumbing.

Inspecting and Testing Occupations. Because aircraft, missiles, and spacecraft are extremely complex and affect the life and safety of people, firms employ workers to conduct thousands of painstaking inspections and tests. Inspectors thoroughly test each component and part as it moves through the production and assembly process, as well as just before delivery. If, for example, a part must withstand a great deal of heat, it will be tested under very high temperatures. Inspections are made not only by employees of the manufacturers but also by commercial firms or agencies of the Federal Government that have contracted for the equipment.

Most inspectors specialize in a certain area of aerospace manufacturing. Using complex machinery, they check to assure that all parts and assemblies were made according to engineering specifications. Among the most skilled inspectors, especially in final assembly plants, are *outside production inspectors* (D.O.T. 806.381) who examine machined parts, subassemblies, and tools and dies ordered from other firms. They also serve as a link between their own engineering department and supplying companies. *Machined parts inspectors* (D.O.T. 609.381) examine machined parts and fabricated sheet-metal and *assembly inspectors* (D.O.T. 806.381) inspect complete major assemblies and installations such as fuselage, wing, and nose sections to insure their proper fit. They also check the functioning of hydraulic, plumbing, and other systems. Less skilled inspectors check subassemblies.

Flight Checkout Occupations. Checking out every part of an aircraft or spacecraft before its first flight requires a team of mechanics. The *crew chief*, the most skilled mechanic of the team, directs other workers in the entire checkout operation. *Engine mechanics* specialize in checking out the powerplant of a craft, including the engine, propellers, and oil and fuel systems; and *electronics checkout* workers do the final examination of the operation of radio, radar, automatic pilot, fire control, and electronic guidance systems. The checkout process may require making minor repairs and, in some cases, even returning the craft to the plant for extensive adjustments.

Flight line mechanic tightens wing pylon during final assembly.

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Materials Handling, Maintenance, and Custodial Occupations. Aerospace plants employ many materials handlers such as truckdrivers, shipping clerks, and toolroom attendants. Maintenance workers, such as electricians, maintenance mechanics, carpenters, and plumbers, keep equipment and buildings in good operating condition and make changes in the layout of the plant. Guards, firefighters, and janitors provide protective and custodial services.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences usually is the minimum requirement for an entry level position as an engineer or scientist in the aerospace industry. Technicians sometimes can advance to these positions without a college degree, but only after years of work experience and some college level training.

New entrants usually qualify for technician positions by attending a technical institute or junior college. Highly skilled plant workers who take courses in areas such as electronics may advance to technician positions.

Entry level plant occupations generally do not require a high school diploma although graduates of vocational courses in electronics or mechanics often are preferred. Inexperienced plant workers generally start out in semiskilled positions and learn skills on the job and in classroom courses. As they gain experience, they can move on to more highly skilled positions. For example, it usually takes 2 to 4 years of plant experience to become a skilled assembler.

Skilled inspectors often have several years of machine shop experience and must be able to install and use various kinds of testing equipment and instruments, read blueprints and other specifications, and use shop mathematics.

Mechanics who do final checkout of aircraft and spacecraft may qualify for their jobs by working in earlier stages of the production line, by receiving training in checkout work, or by working as "line maintenance" mechanics with commercial airlines.

Chief mechanics usually need 3 to 5 years of experience in the manufacture of aircraft, missiles, and spacecraft, including at least 1 year as a checkout mechanic. Specialized mechanics, working under the supervision of a chief mechanic, usually need at least 2 years' experience. Less experienced helpers or assistants learn on the job, with plant training courses.

Apprenticeship programs sometimes are available for craft occupations such as machinists, tool-and-die makers, sheet-metal workers, aircraft mechanics, and electricians. The programs vary in length from 3 to 5 years depending on the trade. During this time, the apprentice handles work of progressively increasing difficulty and also receives classroom instruction. Such instruction for a machinist apprentice, for example, includes courses in blueprint reading, mechanical drawing, shop mathematics, and physics.

Because complex and rapidly changing products require highly trained workers, aerospace plants sometimes support formal training to supplement day-to-day experience and to help workers advance more rapidly. Although most are short-term programs to meet immediate needs, some major producers conduct training classes or pay tuition and related costs for outside courses. Some classes are held during working hours; others are after working hours.

Employment Outlook

Employment in the aerospace industry is expected to rise above recent levels by the mid-1980's. The number of people working in this industry, however, probably will remain below the peak levels of the late 1960's.

Thousands of jobs will open each year because of the growth expected in the industry and to replace workers who retire, die, and transfer to jobs in other industries. Job opportunities are expected to increase for highly trained workers, such as scientists, engineers, and skilled plant personnel in all areas of the industry, especially with firms engaged in R&D and the manufacture of prototype and other technologically advanced aircraft. Less skilled and unskilled workers also will be needed to fill entry level plant positions.

Since many aerospace products are either military hardware or space vehicles, the industry's future depends, to a great extent, on the level of Federal expenditures. Changes in these expenditures usually have been accompanied by sharp fluctuations in aerospace employment. For example, aerospace employment declined sharply from the high levels of the late 1960's partly because of decreased aircraft requirements for Vietnam and reduced expenditures for space exploration. The outlook for this industry is based on the assumption that defense spending will increase moderately from the 1976 level, but will be slightly below the peak levels of the late 1960's. R&D spending also is expected to be above current levels. If actual expenditures should differ substantially from these assumed levels, the outlook will be affected accordingly.

Civilian aircraft production also is an important determinant of aerospace employment. Overall employment in this area is expected to remain fairly stable through the mid-1980's. Nevertheless, thousands of new workers will be required in this sector of the industry to replace those who die, retire, or transfer to other fields.

Earnings and Working Conditions

Plant workers' earnings in the aerospace industry are higher than those in most other manufacturing industries. In 1976, for example, production workers in plants making aircraft and parts averaged $6.45 an hour; production workers in all manufacturing industries as a whole averaged about $5.19 an hour.

The following tabulation indicates an approximate range of hourly wages for selected occupations in 1976 obtained from the collective bargaining agreements of a number of major aerospace companies; these rates do not include incentive earnings. The ranges in various jobs are wide, partly because wages within an occupation vary according to work-

ers' skills and experience, and partly because wages differ from plant to plant, depending upon type of plant, locality, and other factors.

Aircraft mechanics	$5.94–7.15
Assemblers	5.72–6.49
Electronics technicians	6.49–7.45
Heat treaters	5.84–6.77
Inspectors and testers	5.39–7.45
Jig and fixture builders	6.13–7.45
Machinists	5.67–7.45
Maintenance crafts	5.55–7.40
Riveters	5.61–6.27
Tool-and-die makers	6.37–7.45
Welders	5.84–7.17

Fringe benefits in the industry usually include 2 weeks of paid vacation after 1 or 2 years of service, and 3 weeks after 10 to 12 years. Employees generally get 8 to 12 paid holidays a year and 1 week of paid sick leave. Other major benefits include life insurance; medical, surgical, dental, and hospital insurance; accident and sickness insurance; and retirement pensions.

Most employees work in modern factory buildings that are clean, well-lit, and well-ventilated. Some work outdoors. Operations such as sheet-metal processing, riveting, and welding may be noisy, and some assemblers may work in cramped quarters. Aerospace plants, however, are relatively safe.

Most plant workers in the aerospace field are union members. They are represented by several unions including the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; and the International Union of Electrical, Radio and Machine Workers. Some craft workers, guards, and truckdrivers are members of unions that represent their specific occupational groups.

Sources of Additional Information

Additional information about careers in the aerospace field is available from:

National Aeronautics and Space Administration, Washington, D.C. 20546.

Electronics Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

For specific information about an occupation, or apprenticeships contact:

International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

International Union of Electrical, Radio and Machine Workers, AFL-CIO, 1126 16th St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE ALUMINUM INDUSTRY

Aluminum was once considered a specialty metal having limited applications. Today it is produced in quantities second only to iron and steel. It is used in products that range from household appliances and cooking utensils to automobiles, aircraft, and missiles. In recent years, many new uses for aluminum have been developed, including house siding, food and beverage containers, and electrical cables. In 1976, the industry produced about 12.9 billion pounds of primary aluminum, or about twice the output of only 10 years earlier.

This statement describes occupations in plants that produce ingots (bars) of primary aluminum. It also describes occupations in plants that shape the ingots into sheets, wire, and other forms by rolling, stretching, or forcing the aluminum through an opening. Occupations concerned with casting, forging, stamping, machining, and fabricating aluminum are discussed separately in the *Handbook* statements dealing with forge shop, foundry, and metalworking occupations.

More than 93,000 persons worked in the aluminum industry in 1976. Approximately one-third helped make primary aluminum; the remainder helped convert large pieces into sheets, cables, and other industrial products.

Since the huge machinery necessary for making aluminum is very expensive, the production of primary aluminum is concentrated in a relatively small number of plants. These plants generally are located near abundant sources of alumina and electricity. Many are in Arkansas, Louisiana, Texas, Alabama, and Tennessee, where bauxite ore is mined locally or imported from the Caribbean area, and electricity is obtained from the Tennessee Valley Authority or generated from local deposits of natural gas or oil. About two-fifths of the employees who make aluminum work in these States. Another one-fifth work in the State of Washington, where plants obtain electricity from the Bonneville Power Authority and serve customers on the West Coast. A significant number of employees also work in plants located in Ohio, Indiana, and New York.

Plants that shape aluminum into sheets, wire, and other products are more dispersed geographically. Over one-half of the employment in these plants is in California, Pennsylvania, Tennessee, Illinois, Alabama, New York, and Ohio. The remainder is widely scattered throughout a large number of States.

Occupations in the Industry

Employment in the aluminum industry falls into several categories. The largest group of workers—about three-fourths—are the production workers directly involved in operating or maintaining the industry's production equipment. The remaining one-fourth are in professional, technical, administrative, clerical, and supervisory positions.

Production Occupations. To illustrate the production occupations found in the industry, a description of the major steps in making and shaping aluminum follows.

Making Aluminum. Aluminum is obtained from alumina by using electricity to create chemical changes that separate pure aluminum from other materials. Alumina—a fine, white powder processed from bauxite ore—is placed in large containers called "pots" that are filled with a special liquid. Suspended in the liquid are poles (anodes); electric cables are attached to the pots and poles. When the process is in operation, electricity flows from the poles, through the liquid containing the alumina, to the walls and floors of the pots. As the electricity passes through the liquid, it heats and chemically changes the alumina to pure, liquid aluminum. Because the aluminum is heavier, it settles to the bottom of the pot; waste materials go to the top of the liquid. Periodically, pure aluminum is removed from the bottom of the pot.

Pot tenders (D.O.T. 512.885) see that the pots operate continuously. Each is responsible for a number of pots. As a result of the chemical changes, the alumina in each pot is slowly used up. Instruments monitor the level of alumina and signal the tender when to add alumina from the overhead storage compartment.

Every 24 to 72 hours, molten aluminum is drawn from the bottom of the pots into huge brick-lined, steel containers or "crucibles." The *tapper* (D.O.T. 514.884) and *tapper helper* (D.O.T. 514.887) signal the *hot-metal crane operator* (D.O.T. 921.883 place the overhead crane near the pot. Using automatic equipment, they break a hole in the crust of waste materials that forms on the top of the liquid. One end of a curved, cast iron tube is inserted into the pot; the other end is placed into a crucible and the molten metal is drawn from the pot into the crucible.

After aluminum has been taken from several pots and the crucible is full, *charge gang weighers* (D.O.T. 502.887) weigh and sample the molten metal for laboratory analysis. Weighers also select chemicals that the analysis indicates should be blended with the molten aluminum. Then, workers operating overhead cranes pour the molten metal from the crucible into a remelting furnace. A *remelt operator* (D.O.T. 512.885) adds portions of aluminum scrap, other molten metal, or chemicals that will produce metal with the desired properties. Finally, hand skimmers remove waste products that have been forced to the surface of the molten metal.

The metal is then transferred to the second or holding compartment of the furnace until a sufficient supply is obtained for pouring. The *d.c. casting operator* (D.O.T. 514.782) has charge of the pouring station

where the molten metal is cast into ingots—large blocks of metal. The operator controls the cooling conditions of the casting unit by keeping the molds full of metal and spraying water against the molds to produce ingots of uniform size and quality.

After a pot has been operating for a number of months, the heat and chemical reactions make holes in the pot's lining so that the liquid metal contacts the steel container. When this happens, the pot is shut down and the liquid drained so that *pot liners* (D.O.T. 519.884) can make repairs. Depending on the condition of the pots liners may patch holes in the lining or may completely remove and replace the lining.

Shaping aluminum. The large ingots must be reduced in size before the aluminum is useful to customers. Depending on the final product desired, several methods may be used to shape the ingot. Aluminum products such as plate, sheet, and strip are produced by rolling.

The first step in rolling is to remove surface impurities from the ingot. The *scalper operator* (D.O.T. 605.782) manipulates levers of a scalper machine and cuts thin layers of the rough metal from the ingots so that the surfaces are smooth. Then, the ingots are heated to proper working temperatures for rolling. Workers operating overhead cranes lower the ingots into furnaces, or "soaking pits," where they are kept sealed for 12 to 18 hours. *Soaking pit operators* (D.O.T. 613.782) manage the furnace and control the temperature and heating time.

After being heated, the huge ingots are positioned on the "breakdown" or hot rolling mill where they are converted into elongated slabs. *Rolling mill operators* (D.O.T. 613.782) manipulate the ingots back and forth between powerful rollers until they are reduced in thickness to about 3 inches. The slabs then move down the line on the rollers to additional hot mills that work them down to a thickness of about one-eighth of an inch. At the end of the hotline, a *coiler operator* (D.O.T. 613.885) tends a coiler that automatically winds the metal onto reels.

The coiled aluminum cools at room temperature before being cold-rolled still thinner. Cold-rolling produces a better surface finish and increases the metal's strength and hardness. Since continuous cold-rolling could make the metal too brittle, an *annealer* (D.O.T. 504.782) occasionally heats (anneals) the metal.

To relieve internal stress created during the rolling process or surface contours the metal may be stretched. *Stretcher-level-operators* (D.O.T. 619.782) and *stretcher-level-operator helpers* (D.O.T. 619.886) position the finished plate or sheet in clamps, determine the stretch required to remove surface contours, and operate the machine that pulls the metal from end to end to stretch it.

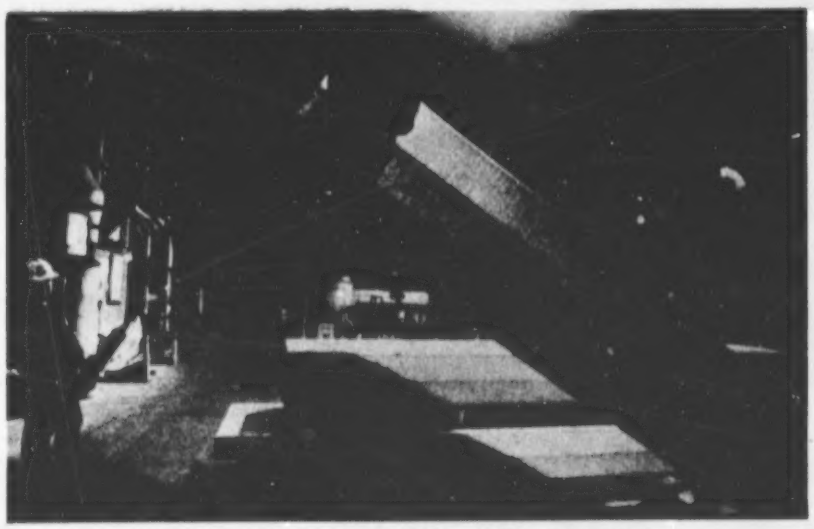
Sometimes ingots are melted and cast in molds to produce "billets." Besides being smaller and easier to handle than ingots, billets can be molded into shapes which make it easier to produce the final product.

In the rod and bar factory, billets are heated to make them softer and then are rolled through progressively smaller openings, until the desired size is obtained. To produce wire, hot-rolling continues until the rod is about three-eighths of an inch in diameter. Then, *wire draw operators* (D.O.T. 614.782) operate machines that pull the cold wire through a series of holes (dies) that gradually reduce its size. The machines also automatically coil the wire on revolving reels.

Structural products such as I-beams and angles may be hot-rolled or extruded. Hot-rolled products are made by passing a square billet with rounded corners between grooved rolls that gradually reduce the thickness and change the shape of the metal.

Extruding of metal often is compared with squeezing toothpaste from a tube. Extruded aluminum shapes are produced by placing hot billets (bars) inside a cylinder in a powerful press. A hydraulic ram that usually has a force of several million pounds pushes the metal through a hole (die) at the other end of the cylinder. The metal takes the shape of the die and then may be cut into desired lengths. By using dies of varying design, almost any shape of aluminium product may be formed. *Extrusion press operators* (D.O.T. 614.782) regulate the rate at which the metal is forced through the press.

Of increasing importance in shaping aluminum is the continuous casting process. This process uses a tall, curved mold that is wider at the top than at the bottom. The mold has an opening at the bottom that is the shape of the final product—for example, it is square if billets are being made. As space becomes available, molten aluminum is added to the top of the mold and moves down through the mold while being cooled by water sprays. When the now solid alumi-



Aluminum ingot is removed from vertical casting unit.

num comes out of the mold, it moves onto a conveyor belt where it is cut to the desired lengths.

During both the production and the shaping process, workers and machines inspect the metal to assure quality. *Radiographers* (D.O.T. 199.381) operate various types of X-ray equipment to inspect the metal. Computers monitor operations and automatically adjust metal temperature and mill speed.

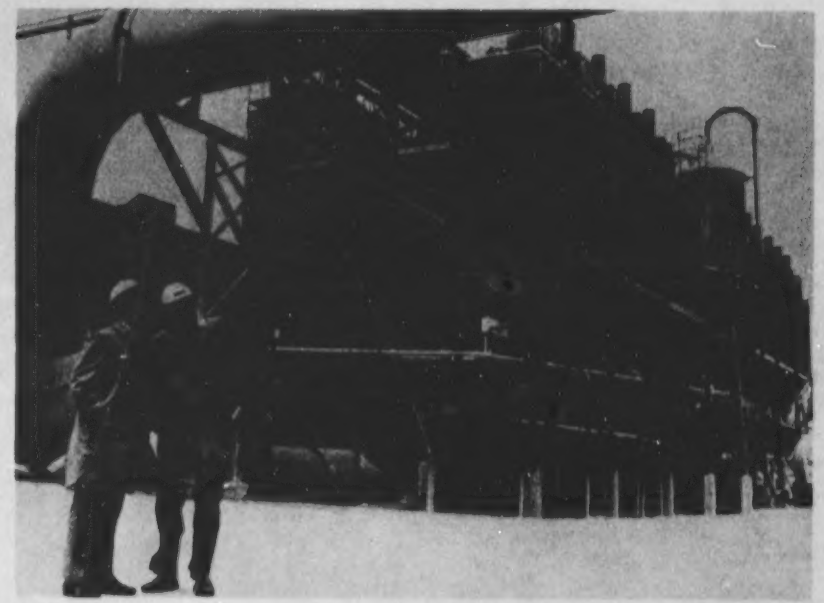
Other production workers in the aluminum industry keep machines and equipment operating properly. Some move materials, supplies, and finished products throughout the plants; still others are in service occupations such as guard and custodian.

Since electricity is vital to making aluminum, the industry needs many electricians to install and repair electrical fixtures, apparatus, and control equipment. Other employees, such as millwrights and maintenance machinists, make and repair mechanical parts for plant machinery. Stationary engineers operate and maintain the powerplants, turbines, steam engines, and motors used in aluminum plants.

Other important groups are the diemakers who assemble and repair dies used in aluminum metalworking operations; the bricklayers who build and reline furnaces, soaking pits, and similar installations; and the welders who join metal parts together with gas or electric welding equipment. In addition, plumbers and pipefitters lay out, install, and maintain piping and piping systems for steam, water, and other materials used in aluminum manufacturing.

Professional, Technical, Administrative, Clerical, and Sales Occupations. About one employee in ten is a professional or technical worker; about the same proportion are clerks. The few remaining workers are in administrative and sales positions.

Aluminum companies employ a variety of professional specialists. Quality control chemists analyze the aluminum and the raw materials used in its production. Process metallurgists determine the most efficient methods of producing aluminum from raw materials. Physical metallurgists test aluminum and aluminum alloys to determine their physical characteristics and also develop new alloys and new uses for aluminum.



Engineers examine air pollution abatement equipment installed in an aluminum plant.

Chemical engineers and mechanical engineers design and supervise the construction and operation of production facilities. Mechanical engineers may design new rolling mills or improve existing mills and related equipment. Electrical engineers plan and oversee the installation, operation, and maintenance of the electric generators and distribution systems used in the manufacture of aluminum. Industrial engineers conduct work measurement studies and develop management control systems to aid in financial planning and cost analysis.

Engineering technicians, laboratory technicians, and chemical analysts assist engineers and chemists in research and development work. Drafters prepare the working drawings that are required to make or repair production machinery.

A wide range of other profesional and administrative workers is needed in the manufacture of aluminum. Top executives manage the companies and determine policy. Middle managers and superintendents direct individual departments, offices, and production operations. The industry also employs other adminstrative personnel, as well as accountants, lawyers, statisticians, economists, and mathematicians. Clerical workers, including bookkeepers, secretaries, stenographers, clerk typists, and keypunch and computer operators keep company records and do other routine office work.

Training, Other Qualifications, and Advancement

Most production workers are hired as unskilled laborers. They generally begin their careers in a labor pool and substitute for absent workers until they become eligible for a permanent positon in a shop or department.

Production workers, such as pot tenders or liners, receive their training on the job. Under the guidance of experienced workers, these employees begin by doing simple tasks and progress to operations requiring progressively greater skill as they acquire experience. As they gain additional skills and seniority, they usually move to more responsible and better paying jobs within their department.

Craft workers usually are trained on the job. A number of companies, particularly the larger ones, have craft apprenticeship programs that

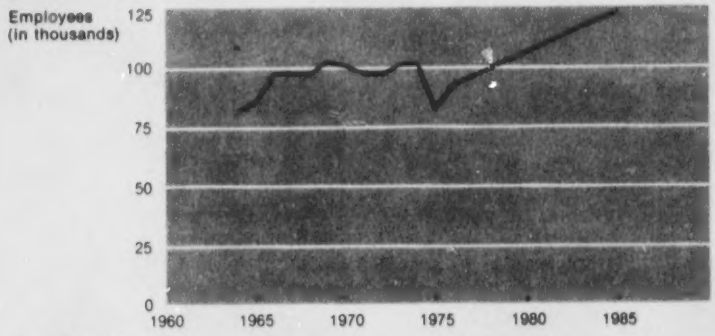
include classroom or home study courses, as well as on-the-job training. Generally, candidates for these programs are chosen from promising young workers already employed by the company. The length of the apprenticeship varies according to the craft, although most require 3 to 4 years. Examples of crafts that can be learned through apprenticeship are: Electrician, welder, brickmason, carpenter, machinist, maintenance mechanic, pipefitter, and general maintenance mechanic.

Applicants and current employees who demonstrate an aptitude for technical work have opportunities to qualify as technicians, laboratory assistants, and other semiprofessional workers. However, some college background in engineering and science, or graduation from a technical institute or community college, is required for many technical jobs.

Most professional jobs require at least a bachelor's degree. Graduate degrees in science or engineering are preferred for research and development work. Administrative and managerial positions usually are filled by workers who have an engineering or science background and have been promoted to these jobs. Some new graduates who have degrees in business administration or liberal arts may fill entry level administrative jobs. Sales positions often are filled by persons with engineering or related technical backgrounds.

Although long-term employment growth is expected in the aluminum industry, the number of job openings each year will fluctuate with economic conditions

Wage and salary workers in aluminum industry, 1964-76, and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Employment in the aluminum industry is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to openings created by growth of the industry, many job opportunities will arise from the need to replace workers who retire, die, or leave the industry for other reasons. The number of job opportunities may vary from year to year, however, because the demand for aluminum fluctuates with the ups and downs in the economy.

Over the long run, the demand for aluminum is expected to grow as population increases and aluminum is substituted for other materials. Industries that represent major markets for aluminum are growing industries with potential for new product development. For example, aluminum studs are replacing wood studs in the construction of large buildings and for residential construction and remodeling. With the growing emphasis on fuel economy, car and truck manufacturers are expected to use more aluminum in the future to reduce the weight of vehicles.

Employment, however, will grow more slowly than the demand for aluminum. Furthermore, the aluminum industry supports a strong research and development program and an aggressive marketing program which should continue to develop new alloys, processes, and products. As a result, the number of engineers, scientists, and technical personnel is expected to increase as a proportion of total employment. Technological developments, such as continuous casting and computer-controlled rolling operations, will limit employment growth among some production occupations.

Earnings and Working Conditions

Hourly earnings of plantworkers in the aluminum industry are higher than the average for manufacturing industries. In 1976, production workers in plants which make aluminum averaged $7.29 an hour, and those in aluminum rolling and drawing plants averaged $6.27. In comparison, production workers in manufacturing industries as a whole averaged $5.19 an hour.

Skilled operators and skilled maintenance and craft workers hold the highest paying plant jobs. Hourly rates in 1976 for selected occupations in a number of plants covered by one major union-management contract are shown below.

Occupation	*Hourly wage rate*
Making Aluminum:	
Anode rebuilder	$7.09
Pot liner	6.57
Pot tender	6.74
Head tapper	7.00
Charge weigher	6.30
Shaping Aluminum:	
Scalper operator	6.74
Soaking pit operator	6.48
Hot mill operator, junior	7.35
Continuous mill operator	7.61
Annealer	6.30
Stretcher and flattener operator	6.39
Inspector	6.57
Extrusion press operator	7.00

Occupation	*Hourly wage rate*
Maintenance:	
Boiler operator	6.57
Brickmason	7.44
Welder	7.35
Pipefitter	7.35
Millwright (maintenance mechanic)	7.35
Electrician	7.61
Machinist	7.61

Aluminum workers receive many fringe benefits, such as paid vacations and holidays, retirement benefits, life and health insurance, shift differentials, supplemental jury-duty pay, and supplemental unemployment benefits. Most workers receive paid vacations ranging from 1 to 4 weeks, depending on length of service. In addition, there are extended vacation plans that provide a 10-week vacation with 13 week's pay every 5 years.

Making aluminum requires high temperatures and some potrooms may be hot, dusty, and smoky. However, working conditions in plants have been improved as a result of control programs and other projects. Because making aluminum is a continuous process, some production employees have to work nights and weekends.

The shaping sector of the industry generally offers more favorable working conditions, although workers in certain jobs are subjected to heat and loud noises.

The industry stresses safe working conditions and conducts safety education programs. Plants where aluminum is made have had a lower rate of injuries than the average for all metal industries, while the rate for aluminum rolling and drawing mills has been about the same as the average. However, the average number of workdays lost for each injury in the aluminum industry has been greater than the average for all metal industries.

Most process and maintenance workers in the aluminum industry belong to labor unions. In addition, labor organizations represent some office and technical personnel. The unions having the greatest number of members in the industry are United Steelworkers of America; Aluminum Workers International Union; and International Union, United Automobile, Aerospace and Agricultural Implement Workers of America.

Sources of Additional Information

Information on aluminum production and uses, as well as careers in the industry, many be obtained from:

The Aluminum Association, 750 Third Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE APPAREL INDUSTRY

Nature and Location of the Industry

The apparel industry produces clothes that not only are appropriate for the occasion—be it work, sleep, or leisure activities—but in such a wide variety of colors and styles that we can select apparel to match our mood and express our personality. In addition to clothes, the industry produces linens and drapes and other products made from cloth such as tents and parachutes. To do all this, the industry employs about 1.3 million people—nearly 4 out of 5 make clothes.

At the beginning of this century, the buildings and streets of Manhattan's Lower East Side bustled with apparel manufacturing activity. New York's styles became the standard for the rest of the country. Buyers for large, out-of-town department stores came to New York City to view new designs and to place orders for winter and summer fashions. Apparel firms in this city not only had the advantage of being near a concentration of buyers, but newly arrived immigrants provided them with an inexpensive supply of workers. New York City was then the undisputed apparel manufacturing capital of the country.

Today, New York City is no longer the Nation's dominant apparel center, although it is still important—almost 1 out of every 5 employees in the industry works in or around New York City. However, many firms have moved to the South so as to lower their taxes and labor costs. As a result, about 25 percent of the industry's employees work in North Carolina, Georgia, Texas, Tennessee, South Carolina, and Alabama. Other firms have moved to large cities such as Los Angeles, Chicago, Boston, St. Louis, and Dallas, where large clothing markets exist.

More than half of the industry's workers are employed in firms that have over 100 employees. Only 1 plant in 7, however, is this large. The limited investment required to cut and sew garments, and the specialization of firms in one operation, such as cutting, allow small firms to enter this industry with relative ease. In the women's and misses' outerwear sector of this industry, for instance, the majority of the cut and sewn garments originate in New York City, but much of the sewing is contracted out to firms spread throughout the Middle Atlantic States. Plants manufacturing men's wear usually are larger than those making women's garments because men's clothing undergoes less frequent changes in design and style and thus is better suited to mass production methods.

Occupations in the Industry

Apparel industry employees, most of whom are directly involved in the production process, carry out the major operations of designing and pattern making, cutting and marking, sewing, and pressing. About half of all apparel employees are hand sewers or sewing machine operators. Generally, high grade and style-oriented apparel is more carefully designed and involves more handwork than cheaper, more standardized items. For example, some hand detailing goes into a fashionable cocktail dress or a high-priced suit or coat, while items such as undershirts and overalls usually are sewn entirely by machine. To make the many different kinds of garments, workers with various skills and educational backgrounds are needed.

Designing Room Occupations. Typically, the manufacturing process begins with the *designer* (D.O.T. 142.081), who creates new types and styles of apparel. Inspiration for a new design may come from any of a variety of experiences—traveling, observing life styles, and looking at paintings and other sources of information about how people dressed in the past, to name but a few. In addition to creativity, designers must have practical knowledge of the apparel business so that they can translate their ideas into styles that can be produced at competitive prices. They must, for example, be familiar with labor processes and costs for various factory operations such as pattern making, cutting, sewing, and pressing.

A large manufacturer generally has a head designer and several assistants. Many small firms, however, do not employ designers but purchase readymade designs or patterns or copy higher priced designs.

A designer usually works with one type of apparel, such as suits or dresses, although some work with several. For a high-quality dress, designers usually start by drawing sketches or draping muslin on a manikin and choosing fabrics, trim, and colors. Using these sketches as guides, designers and their assistants make an experimental dress. They cut materials and pin, sew, and adjust the dress on a form or a live model until it matches the sketch.

Sample makers (D.O.T. 785.381) use this experimental dress as a guide in cutting and sewing fabrics to make a finished sample of the dress. After management has approved the sample, a *pattern maker* (D.O.T. 781.381) constructs a master pattern. Working closely with the designer, the pattern maker translates the sketch or sample dress into paper or fiberboard pieces, each one representing a part of the garment. A *pattern grader* (D.O.T. 781.381) measures the pieces that make up this master pattern, and modifies them to fit various sizes. To speed up this process, some large plants use computers to draw up the patterns for each size.

Styles for many items, such as men's suits and jackets, do not change significantly from year to year; thus, some of the steps described above are not required. A designer may alter the style of a suit, for example, by simply making minor changes on the master pattern.

Cutting Room Occupations. Workers in the cutting room prepare cloth for sewing. There are five basic operations in the cutting department: Spreading, marking, cutting, assembling, and ticketing. Small shops may combine two or more of these operations into a single job.

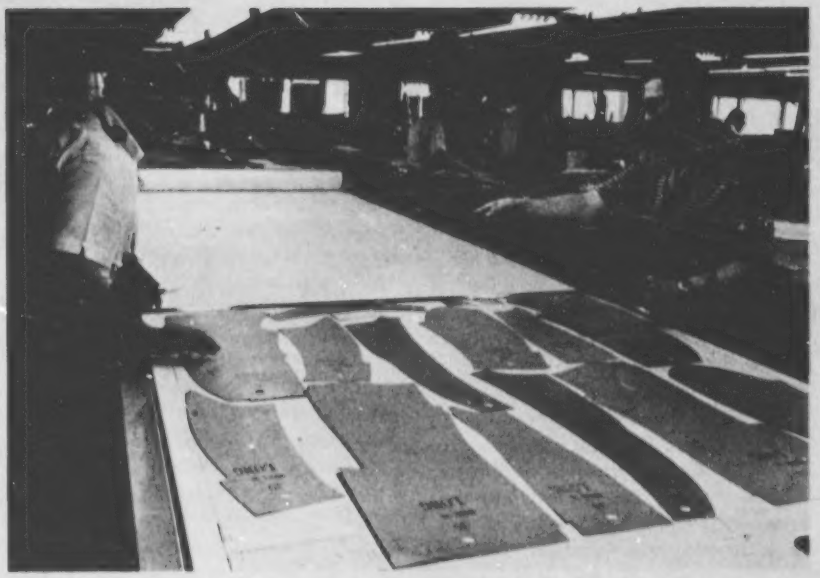
Hand spreaders (D.O.T. 781.887) lay out bolts of cloth into exact lengths on the cutting table. *Machine spreaders* (D.O.T. 781.884) are aided by machines in laying the cloth evenly across the table.

Markers (D.O.T. 781.484) trace the fiberboard pattern pieces on large sheets of paper, and may make several carbons of these tracings. In some cases they trace the pattern pieces with chalk directly on the cloth itself, rather than on paper.

Following the pattern's outline on the cloth, a *cutter* (D.O.T. 781.884) cuts out the various garment pieces from layers of cloth. Sometimes these layers are as high as 9 inches. Using an electrically powered knife, the cutter slices through all the layers at once. The work of a cutter and a marker frequently is combined into a single job.

The pieces of cloth that have been cut are prepared for the sewing room by another group of specialized workers. *Assemblers*, sometimes called *bundlers* or *fitters* (D.O.T. 781.687), bring together and bundle the pieces and accessories (linings, tapes, and trimmings) needed to make a complete garment. They match color, size, and fabric design and use chalk or thread to mark locations for pockets, buttonholes, buttons, and other trimmings. They identify each bundle with a ticket, which is also used to figure the earnings of workers who are paid according to the number of pieces they produce. The bundles then are routed to the various sections of the sewing room.

Sewing Room Occupations. Most production workers in the apparel industry are hand sewers and sewing machine operators. Although hand sewers are needed in the production of expensive garments and to put the finishing touches on moderate-priced clothing, sewing machine operators constitute the great majority of workers in this area.



Markers arrange pattern pieces to get the greatest number of garments from the smallest quantity of cloth.

Using industrial machines that are heavier and run faster than the ones found in the home, *sewing machine operators* (D.O.T. 787.782) generally specialize in a single operation such as sewing shoulder seams, attaching cuffs to sleeves, or hemming blouses. Some make sections such as pockets, collars, or sleeves; others assemble and join these completed sections to the main parts of the garment.

Sewing machine operators generally are classified by the type of machine they use, such as single-needle sewing machine operator or blindstitch machine operator, and by the type of work performed, such as collar stitcher or sleeve finisher.

Most hand sewing is done on better quality or highly styled dresses, suits, and coats. *Hand sewers* (D.O.T. 782.884) use needle and thread to perform various operations ranging from simple sewing to complex

Sewing machine operators use machines that are heavier and run faster than the ones found in the home.

stitching. Many hand sewers specialize in a single operation, such as lapel basting or lining stitching.

Instead of being sewn, parts such as collars and lapels may be "fused" together by heat and pressure. A *fusing machine operator* places the garment part on a loading platform of a fusing press that is adjusted to apply the precise amount of pressure and temperature needed for a permanent bond.

In a typical apparel plant, each operator in the sewing department performs one or two assigned tasks on each piece in a bundle of cut garment pieces, and then passes the bundle to the next operator. Many plants employ *material handlers* (D.O.T. 929.887) who move garment bundles from one sewing operation to another.

At various stages of the sewing operations, *inspectors* and *checkers* (D.O.T. 789.687) examine garments. They mark defects, such as skipped stitches or bad seams, which the inspectors sometimes repair before the garments are passed on to the next sewing operation. *Hand trimmers* (D.O.T. 781.887), often called thread trimmers and cleaners, remove loose threads, basting stitches, and lint from garments.

Tailoring Occupations. *Tailors* (D.O.T. 785.261 and .381) and *dressmakers* (D.O.T. 785.361) are skilled workers who do difficult kinds of hand and machine sewing. Most are employed in making expensive clothing that needs precise shaping and finishing. Although some tailors and dressmakers make complete garments, most specialize in a few operations such as collar setting and lapel padding.

Bushelers (D.O.T. 785.281) are tailors who repair defects in finished garments rejected by the inspector. They alter parts that have not been sewn correctly, rearrange padding in coats and suits, and do other sewing necessary to correct defects.

Pressing Occupations. The shape and appearance of the finished garments depend, to a large extent, on the pressing that is done during and after sewing operations.

Pressers (D.O.T. 363.782, .884, and .885), sometimes working with manikins and body forms, use various types of steam pressing machines or hand irons to flatten seams and shape parts and finished garments. There are two basic types of pressers—underpressers and finish pressers. Underpressers specialize on particular garment parts, such as collars, shoulders, seams, or pockets. Their duties vary from simple smoothing of cloth and flattening of seams to skillful shaping of garment parts. Finish pressers generally do final pressing and ironing at the end of the sewing operations.

Fur Shop Occupations. Because furs are expensive and difficult to work with, making a fur garment requires workers who have special skills not found in plants that make other types of apparel.

The most skilled worker in a fur garment plant is the *fur cutter* (D.O.T. 783.781), who also may be the supervisor. The cutter selects and matches enough fur skins to make a single garment, such as a coat or jacket, and arranges and cuts the skins on pattern pieces so that the choice sections of fur are placed where they will show. Following the sewing instructions given by the cutter, *fur machine operators* (D.O.T. 787.782) sew these pelts together to make garment sections. A *fur nailer* (D.O.T. 783.884), after wetting and stretching the garment sections, either staples or nails them on a board so that they will cover the pattern. When the sections are dry, this worker removes them from the board. To complete the garment, the fur machine operator then finishes sewing the various sections, and *fur finishers* (D.O.T. 783.381) sew in the lining, tape edges, make pockets, and sew on buttons and loops.

Administrative, Sales, and Maintenance Occupations. Most administrative positions in an apparel plant are in the production department. Production managers are responsible for estimating production costs, scheduling the flow of work, hiring and training workers, controlling quality, and supervising the overall production activities of the plant. In some small apparel firms, the production manager also is a designer.

Industrial engineers advise management about the efficient use of machines, materials, and workers. (Further discussion of industrial engineers is included elsewhere in the *Handbook*.)

Clerks, bookkeepers, stenographers, and other office workers make up payrolls, prepare invoices, keep records, and attend to other paperwork. In some large plants, many clerical functions are handled with computers. This requires keypunch operators, computer programmers and operators, and systems analysts. Sales workers, fabric buyers, models, accountants, and sewing machine mechanics and technicians are among other types of workers in the apparel industry. Discussions of many of these jobs can be found elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most workers in the apparel industry pick up their skills on the job by helping and observing experienced workers. The length of time required for on-the-job training ranges from a few weeks to several years, depending on the type of occupation, the worker's aptitude, and the employer's training program. A relatively small number of employees are trained in formal apprenticeship programs for highly skilled occupations, such as pattern maker, cutter, and tailor. Some employees take courses in pattern making, cutting, and tailoring, as well as machine and hand sewing, at private and public schools in apparel manufacturing centers.

Many production jobs do not require much physical exertion. Good eyesight and manual dexterity, however, are vital.

Entry into beginning hand-or machine-sewing jobs is relatively easy, since there are few restrictions regarding education and physical condition. An increasing number of workers, however, are receiving training in high school and vocational schools. New workers start by sewing straight seams, under the supervision of a skilled worker or supervisor, and progress to more complicated sewing as they gain experience. Many large companies have special

in-plant training programs for sewing machine operators. The operator is taught how to perform each operation with minimal finger, arm, and body movement. The ability to do routine work rapidly is essential, since nearly all sewers are paid by the number of pieces they produce. Some sewers advance to supervisory positions. Most, however, stay on the same general operation throughout their working lives and can look forward only to moving from simple sewing tasks to more complicated ones that pay higher piece rates.

New workers in cutting rooms usually begin as assemblers (bundlers or fitters). Speed, patience, and the ability to match colors are necessary for these jobs. An assembler may be promoted to spreader, and after a few years, to marker or cutter.

Most pattern makers pick up the skills of the trade by working for several years as helpers to experienced pattern makers. Cutters and pattern graders occasionally are promoted to pattern making. Pattern makers must be able to visualize from a sketch or model the size, shape, and number of pattern pieces required for a particular garment. They also must have a knowledge of fabrics, body proportions, and garment construction.

For beginning tailor and dressmaking jobs, many employers prefer to hire vocational school graduates who have had courses in these subjects. With a few years of additional apprenticeship or informal on-the-job training, graduates can qualify as skilled workers. Some of these workers eventually become designers or supervisors. They can also transfer to jobs outside the apparel manufacturing industry as fitters and alteration tailors in clothing stores and drycleaning shops.

Pressers usually begin as underpressers, working on simple seams and garment parts. Underpressing can be learned in a short time, and the worker can progress to the more difficult job of finish presser. These workers also can transfer to pressing jobs in drycleaning shops.

Many apparel firms prefer to recruit designers from colleges that offer specialized training in this field. Graduates usually start as assistant designers or sample makers. Some designers, however, have come up through the ranks by advancing from cutting, pattern making, or tailoring jobs.

Designers need a thorough knowledge of fabrics, a keen sense of color, and the ability to translate design ideas into a finished garment. They should also acquaint themselves with garmentmaking techniques by working briefly in various plant jobs, such as sample making, pattern making, cutting, and machine sewing. Designers should know how to sketch.

Production managers and industrial engineers often begin as management trainees. A college education increasingly is being required for these jobs. For those without a college background, many years of on-the-job training in all production processes, ranging from selection of fabrics to shipment of finished apparel, are required to qualify as a production manager.

Employment Outlook

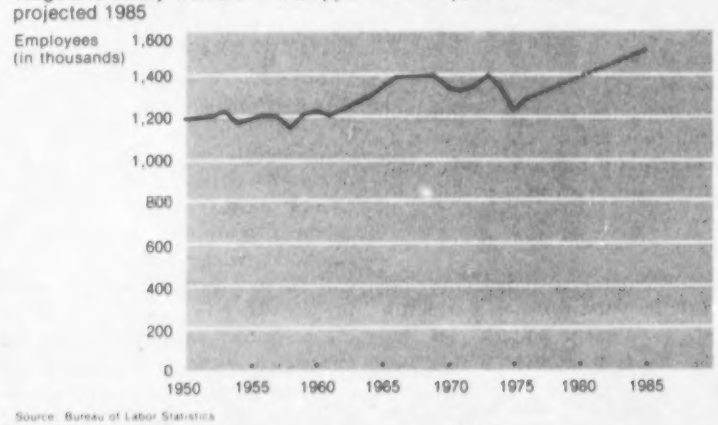
Apparel industry employment is expected to grow about as fast as the average for all industries through the mid-1980's. Most job openings will arise from the need to replace experienced workers who retire, die, or transfer to other fields of work. The number of openings may fluctuate greatly from year to year, as the demand for apparel is highly sensitive to changes in the economy.

Demand for apparel is expected to increase over the long run as population and incomes continue to grow. The industry's greater emphasis on styling also may stimulate demand. Employment in the industry, however, is not expected to keep pace with the production of apparel, because new mechanized equipment and improved methods of production and distribution are expected to result in greater output per worker. Examples of laborsaving equipment include sewing machines that can position needles and trim threads automatically; devices that automatically position fabric pieces under the needle and remove and stack completed pieces; and computer-controlled pattern making, grading, and cutting. Computers also are improving managerial control over sales, inventories, shipping, and production.

Despite technological advances in equipment, extensive application of automatic laborsaving equipment to the production process is difficult because of the variety of items produced and the frequent style and seasonal changes, particularly in clothing. For these and other reasons,

The number of jobs in the apparel industry fluctuates with the economy

Wage and salary workers in the apparel industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

apparel manufacturing operations will continue to require much manual labor. Most employment opportunities will be for sewing machine operators, as this occupational group constitutes approximately 50 percent of total industry employment.

Opportunities are expected to be particularly favorable for production managers and engineers with college degrees in apparel management, engineering technology for apparel, and industrial engineering, as well as for sales workers, fabric buyers, and sewing machine mechanics. Job opportunities also should be favorable for the more high skilled craft workers such as pattern makers, cutters, pressers, finishers, and tailors. People who plan to become designers, on the other hand, will face keen competition, because the number of people trying to get into this field exceeds the number of available jobs.

Table 1. Average hourly earnings of production workers in the men's and boys' suits and coats industry, selected occupations and areas, 1976

Men's and boys' suits and coats	Estimated average hourly earnings		
	New York, N.Y.—N.J. metropolitan area	Baltimore	Philadelphia
All production workers	$4.51	$4.23	$4.47
Cutters and markers	6.95	5.06	6.39
Finishers, hand, coat fabrication	3.81	3.88	3.89
Pressers, finish, machine, coat fabrication	4.99	5.20	5.98
Sewing machine operators, coat fabrication	4.60	4.12	4.47
Sewing machine operators, trouser fabrication	4.50	3.69	3.95

Earnings and Working Conditions

Earnings in the apparel industry are relatively low. In 1976, production workers in apparel averaged $3.41 an hour, compared with $4.87 an hour for those in all private industries, except farming.

Average hourly earnings of production workers varied among different kinds of apparel plants, ranging from $3.03 in plants that made hats, caps, and millinery to $4.18 in those that made men's and boys' suits and coats. Earnings of apparel workers also varied by occupation and geographic area. Table 1 gives estimated average hourly earnings in 1976 for selected occupations and areas in one segment of the industry.

Because most production workers in the apparel industry are paid by the number of pieces they produce, their total earnings depend upon speed as well as skill.

Many apparel workers are union members, particularly those who work in metropolitan areas. The major unions in this industry are the International Ladies' Garment Workers' Union, the Amalgamated Clothing and Textile Workers' Union, and the United Garment Workers of America. Some of these unions sponsor health care and child day care centers, cooperative housing, and vacation resorts for the benefit of their members.

Workers may be laid off for several weeks during slack seasons, particularly in plants that make seasonal garments, such as women's coats and suits. Employment is usually more stable in plants that produce standardized garments, such as pajamas and men's shirts, which are worn all year. In many plants, the available work during slack periods is divided so that all workers can be assured of at least some earnings.

While many plants are housed in old buildings, others are located in modern buildings that have ample work space, good lighting, and air-conditioning. Because most employees sit when they sew, the work is not physically strenuous, but the pace is rapid and many tasks are monotonous.

Working conditions in cutting and designing rooms are more pleasant than in the sewing and pressing areas. The cutting and designing rooms are in an area away from the hustle and bustle of the sewing and pressing operations, and designing, pattern making, and cutting jobs are more interesting and less monotonous than most other apparel jobs.

Sources of Additional Information

Information on vocational and high schools that offer training in designing, tailoring, and sewing may be obtained from the Division of Vocational Education of the Department of Education in each State capital.

Information on apprenticeships may be obtained from the Apprenticeship Council of the State labor department or the local office of State employment service. Some local employment service offices administer tests to determine aptitudes that are important for many apparel industry jobs.

For general information on jobs in the industry and information on schools that offer degrees in apparel management, engineering technology for apparel, design, and related professional and vocational fields, write to:

American Apparel Manufacturers Association, Suite 800, 1611 N. Kent St., Arlington, Va. 22209.

Amalgamated Clothing and Textile Workers' Union, 15 Union Square, New York, N.Y. 10003.

Fur Information and Fashion Council, 101 W. 30th St., New York, N.Y. 10001.

International Ladies' Garment Workers' Union, 1710 Broadway, New York, N.Y. 10019.

National Outerwear and Sportswear Association, Inc., 1 Pennsylvania Plaza, New York, N.Y. 10001.

United Garment Workers of America, Room 1614, 200 Park Ave. South, New York, N.Y. 10003.

Apparel Manufacturers' Association, 1440 Broadway, New York, N.Y. 10018.

National Knitted Outerwear Association, 51 Madison Ave., New York, N.Y. 10010.

OCCUPATIONS IN THE BAKING INDUSTRY

The baking industry—one of the Nation's largest food-processing employers—provides steady, year-round employment for thousands of workers throughout the country. Jobs exist to suit a wide variety of interests, skills, and talents. Bakery workers make, wrap, pack, sell, and deliver products. Mechanics maintain and repair plant machinery and service delivery trucks. Managers and sales specialists direct operations and clerical workers perform regular office duties.

Nature and Location of the Industry

About 240,000 persons worked in the Nation's 3,500 industrial bakeries in 1976. More than 4 out of 5 worked in bakeries that produced perishable goods such as bread, rolls, pies, cakes, and doughnuts. The remainder worked in those that made "dry" goods such as cookies, crackers, and pretzels.

Although there are many small bakeries, the larger plants account for most of the employment. About three-fourths of the industry's employees are in plants with more than 100 workers.

Most jobs are concentrated in metropolitan areas and most of the industry's employees are production workers. They do the baking, handle raw materials, maintain equipment, wrap and pack products, and keep the bakeries clean. Nearly 1 out of 4 drives a truck to deliver the industry's products; most of these workers sell to retail stores. Other drivers with no sales duties deliver bakery products to distribution centers, hotels, restaurants, and stores. The remaining 20 percent of the work force are in administrative, professional, technical, and clerical jobs.

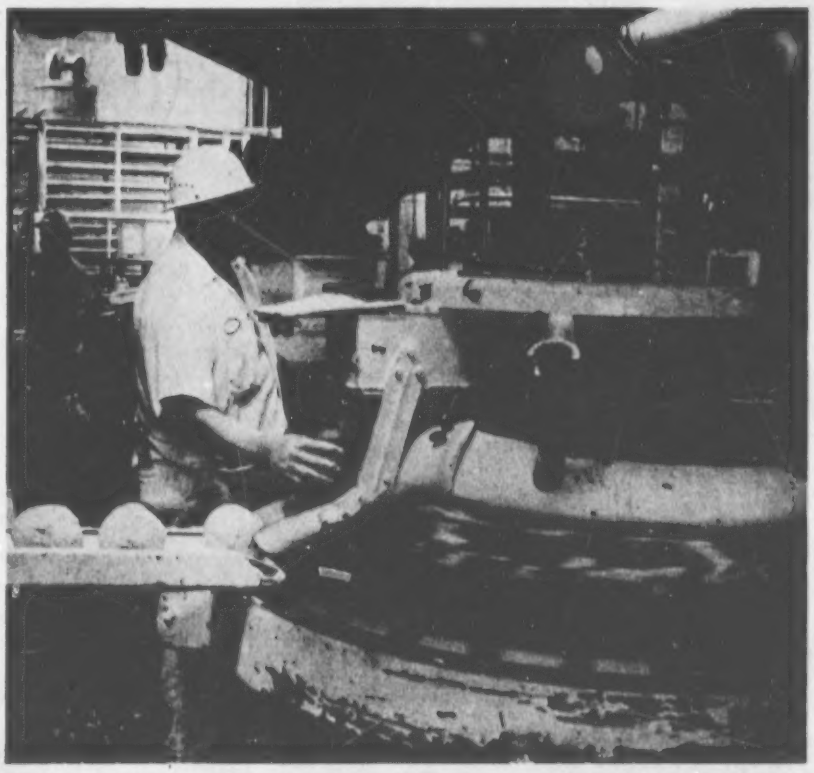
Production Occupations. Although not all baked goods are made in exactly the same way, most bakery production jobs are similar. Production workers blend, sift, and mix ingredients to form a dough; shape and bake the dough; and wrap and pack the final product.

Since bread is the primary product of the industry, occupations described here are those found in a bread bakery. Jobs may differ somewhat in a bakery that makes other products or is more automated.

The first step in baking is to combine the ingredients needed to make dough. *Mixers* (D.O.T. 520.885) load blending machines with the exact amounts of flour, water, and yeast needed for the bread. Using instruments, they carefully control the temperature, timing, and mixing speed of the machines to insure a uniform, well-blended dough. The mixed dough is dropped into a trough and pushed to a warm proofing room where the yeast ferments and the dough rises. The risen dough is poured back into the blender and sugar, salt, shortening, and more flour and water are added. The dough is allowed to rise again before it is shaped into loaves.

Divider machine operators (D.O.T. 520.885) run machines that divide, round, proof, and shape dough into loaf-size balls. A conveyor carries these balls of dough to *dough molders* or *molding machine operators* (D.O.T. 520.885) who press out the air bubbles, form the balls into loaves, and drop the loaves into pans. If bread or rolls are to be made in fancy shapes, *bench hands* (D.O.T. 520.884) knead and form the dough by hand.

The pans of dough go back to the proofing room for about an hour before being placed in the oven. *Oven tenders* (D.O.T. 526.885) load



Divider machine operator runs machine that divides and shapes dough into loaves.

Oven tender loading pans of dough into oven.

and unload the ovens and adjust the temperature and timing of the ovens to make sure that the bread is properly baked.

Some bakeries use an automatic process called "continuous mix" that eliminates many of the steps described above. With this process, all ingredients are mixed at once and the dough is divided, shaped, put into pans, and then proofed only once before baking.

In small bakeries, *all-round bakers* (D.O.T. 526.781) assisted by helpers, usually handle all the steps needed to turn out finished baked products. In large bakeries, all-round bakers are employed as working supervisors. They direct their employees and coordinate their activity with other departments to meet production schedules.

A considerable number of *helpers* (D.O.T. 526.886) are employed in baking operations to grease pans, remove bread from pans, push troughs and racks, and wash pans. They may assist all-round bakers and other workers. They have job titles such as doughmixer helper, and oven tender helper.

After baked goods are cooled, several types of workers prepare them for delivery to customers. *Slicing-and-wrapping machine operators* (D.O.T. 521.885) feed loaves of bread onto conveyors leading to the machines, watch the slicing and wrapping operations, adjust the machines, and keep them supplied with bags and labels. A conveyor then takes the wrapped loaves to the shipping platform.

Bakery employees in icing departments give finishing touches to cakes, pastries, and other sweet goods following special formulas of the bakery. *Icing mixers* (D.O.T. 520.885) weigh and measure ingredients and mix cake icings and fillings by machine. They also prepare cooked fillings for pies, tarts, and other pastries. *Hand icers* (D.O.T. 524.884) are skilled workers who decorate special products such as wedding cakes, birthday cakes, and fancy pastries. When the product is uniform or requires no special decoration, the frosting may be applied by *machine icers* (D.O.T. 524.885).

Bakeries also employ many workers in storage, warehousing, and shipping departments. Receiving and stock clerks check, record, and deliver incoming supplies and ingredients to various departments. Packers and checkers make up orders of bakery products for delivery by route drivers.

Maintenance Occupations. Bakeries employ skilled maintenance workers such as machinists, electricians, and stationary engineers to keep machinery and equipment in good condition. Large plants need many of these workers because their baking operations are highly mechanized. Many bakeries also employ truck mechanics to service their delivery trucks.

Sales and Driving Occupations. Selling and delivering finished baked foods requires many thousands of workers. Some sell baked goods, some drive trucks, and many do both.

Route drivers (D.O.T. 292.358) work for wholesale bakeries. They deliver baked foods to grocery stores along their routes and collect payment. Attracting new customers and urging old customers to buy more products are major parts of their job. Route drivers usually arrange their baked goods on shelves or display racks in grocery stores although some stores have begun to use their own employees to stock shelves. Drivers also list the items they think the grocers will buy the next day; these lists are used to help make up the bakery production schedule for the next morning.

Route supervisors assign delivery routes and check delivery schedules. They train new route drivers and may temporarily replace those who are absent. A large bakery may employ several supervisors, each in charge of 6 to 10 route drivers.

Chain grocery store bakeries and multioutlet retail bakeries employ truckdrivers rather than route drivers to deliver baked foods to each of their company's stores. Truckdrivers do not have sales duties, nor, in most areas, do they stock shelves. Each store's stock clerks or sales clerks arrange the displays of baked foods.

Administrative, Clerical, and Professional and Technical Occupations. Administrators in large bakeries and

owners of small bakeries coordinate all baking activities, from the purchase of raw materials to the production and delivery of finished goods. In large firms, activities are divided into separate departments or functions and are supervised by plant managers, comptrollers, sales managers, and other executives. Some administrative employees specialize in fields such as accounting, purchasing, advertising, personnel, and industrial relations. Bakeries employ many types of clerical workers, including bookkeepers, cashiers, clerks, business machine operators, typists, and switchboard operators. Some large baking companies have laboratories and test kitchens where chemists, home economists, and their assistants test ingredients and prepare formulas and recipes. (Detailed discussion of the duties, training, and employment outlook for maintenance, sales, driving, administrative, clerical, and technical personnel appear elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Training requirements for occupations in the baking industry range from a few days on the job to several years of experience or advanced education. Slicing and wrapping machine operators can learn their job in a few days, but skilled workers, such as all-round bakers, mixers, oven tenders, and other baking specialists, need 3 or 4 years of training. Professional personnel and some administrative workers must have a college degree or considerable experience in their specialty.

Most inexperienced production workers in the baking industry are hired as helpers. They usually are assigned such tasks as carrying ingredients to mixing machines, or pushing troughs of dough to the proofing room. Many workers who become all-round bakers begin as baker's helpers. They learn more advanced baking skills while working alongside experienced bakers, and may be selected to enter an apprenticeship program. Employers usually require an apprentice to be at least 18 years old and have a high school or vocational school diploma. Apprenticeship programs last 3 or 4 years, and include on-the-job training in all baking operations and classroom instruction in related subjects.

Some workers take courses in vocational school or learn baking in the Armed Forces. Such training may not qualify a person as a skilled baker, but it may help in getting a job as an apprentice or shorten the apprenticeship training period.

Bakers may be promoted to jobs such as working or department supervisors. Some bakers who have developed special skill in fancy cakemaking or piemaking may find jobs in hotel or restaurant bakeries. All-round bakers with some business ability sometimes open their own bakeshops.

Production employees must be in good health. Most States require a health certificate indicating that the worker is free from contagious diseases. Good health also is important because of the high temperature in bakeries.

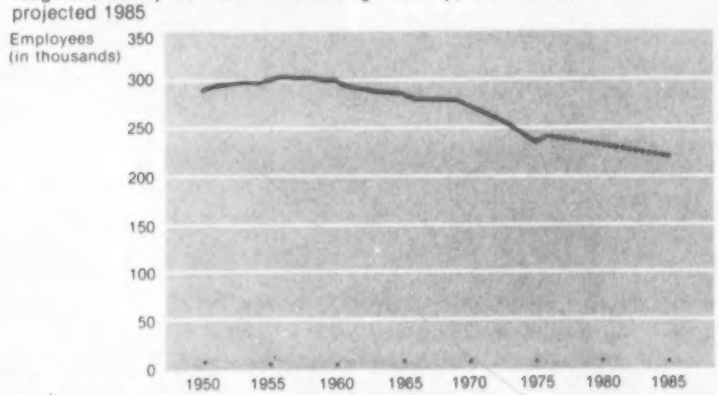
Some bakeries have apprenticeship programs for maintenance workers such as machinists, electricians, and mechanics. Others train maintenance workers informally on the job. Some bakeries hire only maintenance workers who are already skilled.

For route drivers or truckdrivers, baking firms generally hire inexperienced people with a high school education. These workers often begin as stock clerks, packers, or checkers, and are promoted to driving jobs. Applicants must be able to get a chauffeur's license and sometimes are tested by the baking companies to determine whether they are safe drivers. Classroom instruction in sales, display, and delivery procedures is sometimes given to new route drivers, but most training is given on the job by supervisors. Route drivers may be promoted to route supervisors or sales managers.

Administrative jobs usually are filled by upgrading personnel already employed in the firm. Some owners and production managers of bakeries have been plant workers or were in sales occupations. In recent years, large baking firms have required their new administrative workers to have a college degree in an administrative field, such as marketing, accounting, labor relations, personnel, or advertising. Kansas State University at Manhattan offers a bachelor of science degree in bakery science and management. The American Institute of Baking conducts a school of baking for persons who wish to qualify for managerial positions. Applicants must have a high school diplo-

Technological innovations enable bakeries to meet increased demand with fewer employees

Wage and salary workers in the baking industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

ma and 2 years of baking experience or equivalent time in college.

Persons who have completed a commercial course in high school, junior college, or a business school usually are preferred for secretarial, stenographic, and other clerical jobs.

Employment Outlook

Employment in the baking industry is expected to decline through the mid-1980's. Nevertheless, several thousand job openings are anticipated each year because of the need to replace workers who retire, die, or transfer to other fields of work.

Population growth will increase the demand for bakery products. However, laborsaving technological innovations will enable many bakeries, particularly large industrial ones, to meet the demand with fewer employees. Pneumatic handling systems and pumps quickly and easily transfer ingredients from trucks or railroad cars to storage containers. The "continuous mix" process eliminates doughmixing and proofing operations, and conveyor systems move panned dough from ovens to labeling machines in one continuous process. In addition, some bakeries can prepare a week's baked goods at one time and store them in the freezer until needed.

Earnings and Working Conditions

In 1976, earnings of production workers in the baking industry averaged $202.27 a week, or $5.16 an hour, which is slightly higher than the average for all workers in private industry, except farming.

Under the terms of union contracts covering employees in some wholesale bakeries producing bread and related products, minimum hourly rates in major occupations in 1976 were as follows:

Baking supervisors	$5.84–7.49
All-round bakers and mixers	4.81–7.04
Molders and dividers and molding and dividing machine operators	4.62–7.04
Oven tenders	4.81–7.04
Baker's helpers	4.44–6.95
Wrapping machine operators	4.81–6.29

Some plant employees work night shifts and weekends because many bakeries operate around the clock. Some bakeries are eliminating the night shift since baked goods can be frozen and stored until needed. Most plant workers are on a 40-hour workweek, but some work 35 or 37 1/2 hours, and others 44 to 48 hours.

Route drivers usually receive a guaranteed minimum salary plus a percentage of their sales. According to limited information from union contracts, route drivers for wholesale bakeries had minimum weekly salaries of from $123 to $283 in 1976. By selling more baked products to more customers, route drivers can increase their earnings. Companies generally pay for uniforms and their maintenance.

Working conditions in bakeries are generally good. However, many jobs involve some strenuous physical work, despite the considerable mechanization of baking processes. Work near ovens can be uncomfortably hot.

Nearly all employees of industrial baking firms get paid vacations, which usually range from 1 to 5 weeks according to length of service. Employees also get from 5 to 11 paid holidays, depending on the locality. Most baking companies have life and health insurance programs and retirement pension plans. Many employees are covered by joint union-industry plans that are paid for entirely by the company.

Many bakery workers belong to labor unions. Bakers and other plant workers are organized by the Bakery and Confectionary Workers' International Union of America, and route drivers and truck drivers usually are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind.). Some maintenance workers are members of craft unions such as the International Association of Machinists and Aerospace Workers and the International Union of Operating Engineers.

Sources of Additional Information

Information on baking jobs and training opportunities may be obtained from bakeries in the community, local offices of the State employment service, or locals of the labor unions noted previously.

For general information on job opportunities in the industry and on schools that offer courses or degrees in baking science and technology, write to:

American Bakers Association, 2020 K St. NW., Suite 850, Washington, D.C. 20006.

OCCUPATIONS IN THE DRUG INDUSTRY

References to potions and spells for the cure and prevention of pain and disease are numerous in medical folklore. But 20th century science has created a supply of drug products undreamed of by even the most imaginative apothecaries of the past.

More than 10,000 individual or combination drug products are available to today's physician for diagnostic, preventive, and therapeutic uses. These drugs have resulted in the control of venereal disease, tuberculosis, influenza, cardiovascular disease, malaria, pneumonia, and even some forms of cancer. Hormones have relieved the pain and crippling effects of arthritis and other diseases. Tranquilizers and other drugs have done much to reduce the severity of mental illness. Vaccines have reduced dramatically the toll of polio, whooping cough, and measles. Discoveries in veterinary medicine have increased animal productivity and controlled various diseases, some of which are transmissible to humans. New drugs which control symptoms of various diseases and disorders have resulted in remarkable benefits to society by increasing life expectancy and allowing many ill people to lead full and reasonably normal lives.

The American drug industry has achieved worldwide prominence through its activities in research and development of new drugs, and spends a higher proportion of its funds for research than any other industry in the United States. About 80 percent of research and development expenditures is devoted to the advancement of scientific knowledge and the development of new products. The remaining funds are allocated to the improvement of existing products. Each year the industry tests more than 150,000 new substances which may eventually yield only 10 to 20 completely new, useful medicines. In recent years, most research has been devoted to infections, diseases of the central nervous and cardiovascular systems, and to neoplasm therapy (treatment of abnormal tissue growth).

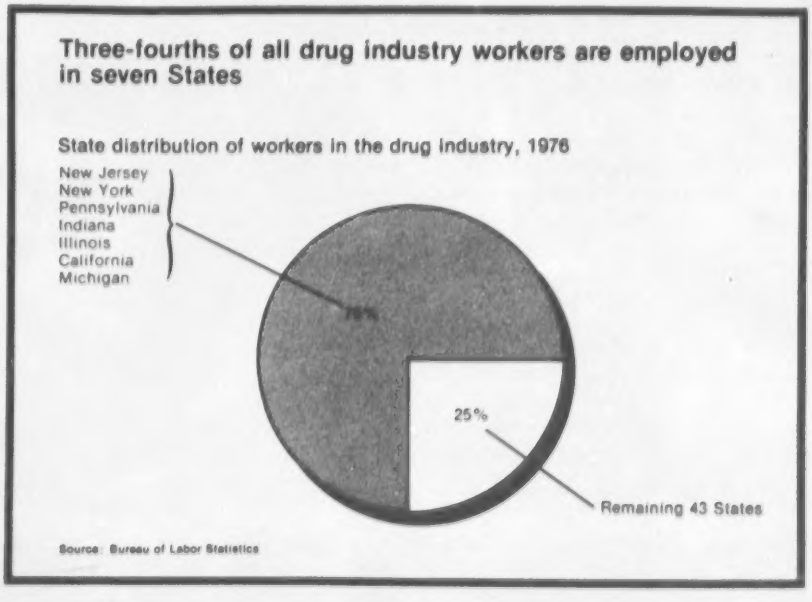
Drug firms also are involved in research and the development of other types of products and chemicals. Closely related to drugs as important adjuncts to modern medical care are medical devices and diagnostic products. Many pharmaceutical as well as other manufacturers in the past few years have entered the fast growing production of radiological equipment, radio-pharmaceuticals, heart pacemakers, dialysis machines, and numerous other products. These are used to diagnose disease on one hand or, like drugs, help alleviate symptoms and restore health and well-being. Many firms also are involved in the agricultural chemical market. Many of the same types of employees required in the research and quality control-oriented production of human and animal-use drugs also are required in these other areas.

Nature and Location of the Industry

In 1976, about 165,000 persons worked in the drug industry. Over 130,000 worked for companies that made pharmaceutical preparations (finished drugs), such as tranquilizers, antiseptics, antibiotics, and analgesics. The remainder worked for firms that made biological products, such as serums, vaccines, toxins, plasmas, and bulk medicinal chemicals and botanicals used in making finished drugs.

Drug manufacturing companies typically employ large numbers of workers. About two-thirds of the industry's employees work for firms with more than 500 workers; over one half work for firms employing over 1,000 workers. Some of the largest firms employ more than 5,000 workers. The Pharmaceutical Manufacturers Association (PMA) represents about 130 companies that produce most of the Nation's pharmaceuticals, accounting for over 90 percent of total drug sales.

About three-fourths of the industry's employees worked in seven States: New Jersey, New York, Pennsylvania, Indiana, Illinois, California,



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and Michigan. Large drug manufacturing installations are located in *Indianapolis, Ind.; Chicago, Ill.; Nutley* and Rahway, N.J.; Philadelphia, Pa.; Kalamazoo, Mich.; Pearl River and Brooklyn, N.Y.; and in the Los Angeles and San Francisco, Calif., areas.

For testing new drugs, a primary research method called screening is used. In screening an antibiotic, for example, a sample is first placed in a bacterial culture. If the antibiotic is effective, it is next tested on infected laboratory animals. Each year research personnel study the effects of potential new medicines on millions of animals including mice, rats, chickens, and guinea pigs. Promising compounds are studied further for evidence of useful—and harmful—effects. A new drug is selected for testing in humans only if it promises to have therapeutic advantages over comparable drugs already in use, or if it offers the possibility of being sa-

About 1 out of every 6 employees in the drug industry is a scientist, engineer, or technician.

After laboratory screening, a clinical investigation, or trial of the drug on human patients, is made. Supplies of the drug are given to a small group of doctors who administer it to carefully selected consenting patients. The patients are then observed closely and special studies made to determine the drug's effect. If a drug proves useful, arrangements are made for more tests with a larger group of physicians.

Once a drug has successfully passed animal and clinical tests, problems of production methods and costs must be worked out before manufacturing begins. If the original laboratory process of preparing and compounding the ingredients is complex and expensive, pharmacists, chemists, chemical engineers, packaging engineers, and production specialists are assigned to develop processes economically adaptable to mass production.

Drug manufacturers have developed a high degree of automation in many production operations. Milling and micronizing machines (which pulverize substances into extremely fine particles) are used to reduce bulk chemicals to the required size. These finished chemicals are combined and processed further in mixing machines. The mixed ingredients may then be mechanically capsulized, pressed into tablets, or made into solutions. One type of machine, for example, automatically fills, seals, and stamps capsules. Other machines fill bottles with capsules, tablets, or liquids, and seal, label, and package the bottles.

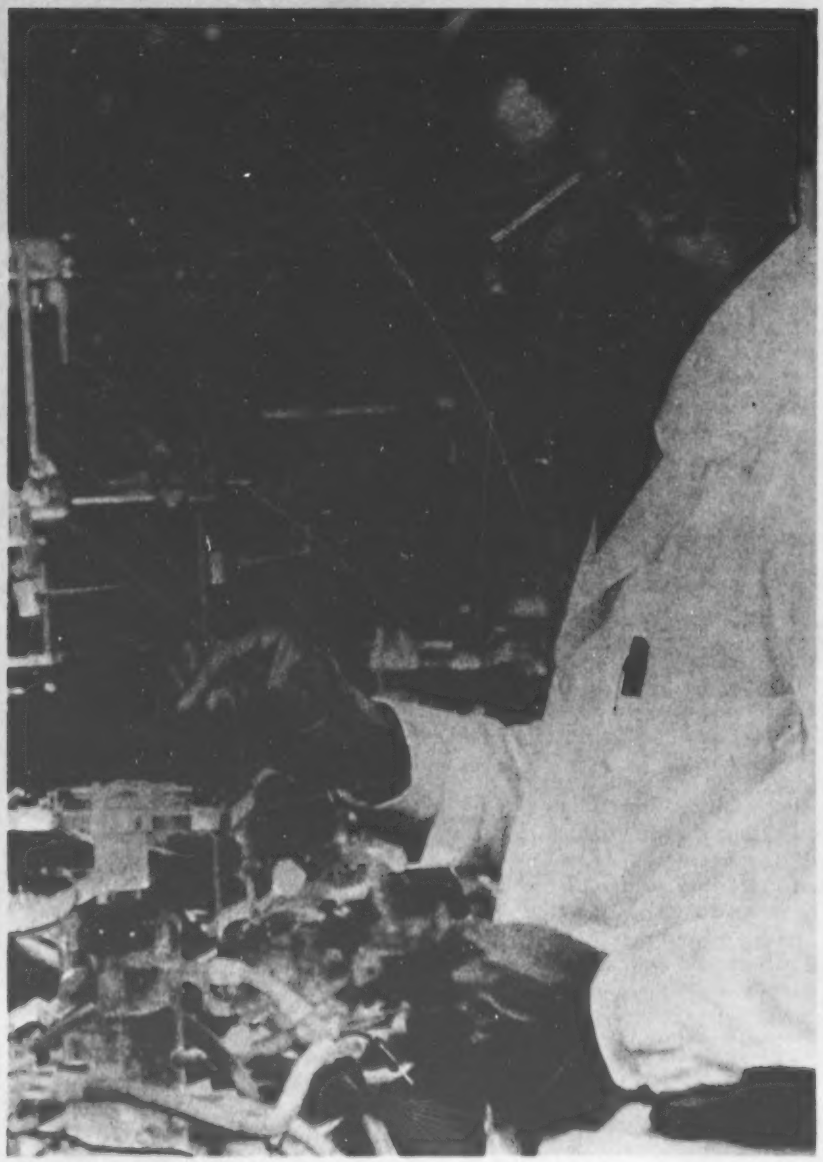
Quality assurance 6r control is vital in this industry. A quality control system involves selection and training of personnel; product design; establishment of specifications, procedures, and tests; design and maintenance of facilities and equipment; selection of materials; and recordkeeping. In an effective system, all these aspects of quality control are evaluated on a regular basis, and modified and improved when appropriate. Quality-conscious manufacturers may assign one of every six production workers to quality assurance functions alone, while all other employees may devote part of their time to these functions. For example, although pharmaceutical company representatives called detailers primarily work in marketing, they engage in quality control when they assist pharmacists in checking for outdated products.

A drug may undergo hundreds of complex, time-consuming quality control checks at various stages during the manufacturing process to insure that it conforms to spe ifications. Although some inspection operations are mechanized, many are performed manually.

The pharmaceutical industry is closely regulated. The Food and Drug Administration (FDA) has legal authority to inspect manufacturing plants, test drugs and examine drug imports, and monitor drug research, testing, development, marketing, and consumption.

Occupations in the Industry

Employees with many different levels of skill and education work in the drug industry. About half are in white-collar jobs (scientific, technical, administrative, clerical, and sales), a much higher proportion than in most other manufacturing industries; the other half are in plant jobs (processing or production,



Biologist conducts tests that monitor the effect of different compounds on heart muscle.

maintenance, transportation, and service).

Some of the important occupations are described briefly below. Detailed discussions of professional, technical, clerical, and other occupations found in drug manufacturing, as well as in other industries, are given elsewhere in the *Handbook*.

Scientific and Technical Occupations. About one out of every six employees in the industry is a scientist, engineer, or technician—a far greater proportion than in most other industries. The majority do research to develop new drug products. Others work to streamline production methods and improve environmental and quality control.

Chemists (D.O.T. 022.081) make up the largest group of scientific and technical personnel in the industry. Organic chemists combine new compounds for biological testing. Physical chemists separate and identify substances, determine molecular structure, help to create new compounds, and improve manufacturing processes. Biochemists study the action of drugs on body processes. Radiochemists trace the course of drugs through body organs and tissues. Pharmaceutical chemists set standards and specifications for the form of products and for storage conditions and see that labeling and literature meet the requirements of State and Federal laws. Analytical chemists test raw and intermediate materials and finished products for quality.

Several thousand *biological scientists* (D.O.T. 041.081, .181) work in the drug industry. Biologists and bacteriologists study the effect of chemical agents on infected animals. Microbiologists grow strains of microorganisms which produce antibiotics. Physiologists investigate the effect of drugs on body functions and vital processes. Pharmacologists and zoologists study the effect of drugs on animals. Virologists grow viruses, develop vaccines, and test them in animals. Botanists, with their special knowledge of plant life, contribute to the discovery of botanical ingredients for drugs. Other biological scientists include pathologists, who study normal and abnormal cells or tissues, and toxicologists, who are concerned with the safety, dosage levels, and the compatibility of different drugs. Pharmacists perform research in product development, studying many forms of medicines at various stages of production. Some set specifications for the purchase and manufacture of materials, and handle correspondence relating to products. Drug manufacturers also employ physicians and veterinarians.

Engineers account for a small fraction of scientific and technical workers, but make significant contributions toward improving quality control and production efficiency. *Chemical engineers* (D.O.T. 008.081) design equipment and devise manufacturing processes. *Industrial engineers* (D.O.T. 012.081, .168, .187, .188, and .281) plan equipment layout and workflow to maintain efficient use of plant facilities. *Mechanical engineers* (D.O.T. 007.081, .151, .181, and .187) coor-

dinate the installation and maintenance of sterilizing, heating, cooling, humidifying, and ventilating equipment.

Technicians (D.O.T. 073.381, 078.128, .168, .281, .381, and .687) represent about one-third of the drug industry's scientific and technical workers. Laboratory tests play an important part in the detection and diagnosis of disease and in the discovery of medicines. Laboratory technicians perform these tests under the direction of scientists in such areas as bacteriology, biochemistry, microbiology, virology (the study of viruses), and cytology (analysis of cells).

Administrative, Clerical, and Related Occupations. About 1 out of every 3 workers in drug manufacturing is in an administrative, clerical, or other office job. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, marketing, and research. Other administrative and executive workers include accountants, lawyers, purchasing agents, personnel and labor relations workers, public relations workers, economists, technical writers, computer specialists, and advertising and marketing research workers. Clerical employees include secretaries, typists, office machine operators, and others who keep records on personnel, payroll, raw materials, sales, shipments, and plant maintenance.

Pharmaceutical detailers (D.O.T. 266.158), often called pharmaceutical sales representatives, describe their companies' products to physicians, pharmacists, dentists, and health services administrators, and serve as lines of communication between their companies and clients.

Plant Occupations. Nearly half of the industry's employees work in plant jobs. The majority of these workers can be divided into three major occupational groups: production or processing workers, who operate the drug-producing equipment; maintenance workers, who install, maintain, and repair this equipment; and shipping clerks, truckdrivers, and material handlers, who help transport the drugs.

Various types of chemical operators are involved in the production of pharmaceutical preparations and biological products. *Pharmaceutical operators* (D.O.T. 559.782) control machines that produce tablets, capsules, ointments, and medicinal solutions. *Granulator machine operators* (D.O.T. 559.782) tend milling and grinding machines that reduce mixtures to particles of designated sizes. *Compounders* (D.O.T. 550.885) tend tanks and kettles in which solutions are mixed and compounded to make up creams, ointments, liquid medications, and powders. *Compressors* (D.O.T. 556.782) operate machines that compress ingredients into tablets. *Pill and tablet coaters* (D.O.T. 554.782), often called capsule coaters, control a battery of machines that apply coatings to tablets which flavor, color, preserve, add medication, or control disintegration time. *Tablet testers* (D.O.T. 559.687) inspect tablets for hardness, chippage, and weight to assure conformity with specifications.

Ampoule fillers (D.O.T. 559.885) operate machines that fill small glass containers with measured doses of liquid drug products. *Ampoule examiners* (D.O.T. 559.687) examine the ampoules for discoloration, foreign particles, and flaws in the glass.

After the drug product is prepared and inspected, it is bottled or packaged. Most of the packaging and bottle filling jobs are done by semiskilled workers who operate machines that measure exact amounts of the product and seal containers.

The drug industry employs many skilled maintenance workers to assure that production equipment is operating properly and to prevent costly breakdowns. Included among maintenance workers are powerplant operators who are responsible for high pressure boilers, turbogenerators, compressors, refrigeration equipment, and plant water systems; electricians who install, maintain, and repair the various types of electrical equipment; plumbers who install and maintain heating, plumbing, and pumping systems; machinists who make and repair metal parts for machines and equipment; and instrument repairers who periodically inspect instruments and controls and repair or replace malfunctioning parts. Drug firms also employ pipefitters, millwrights, and many other skilled workers.

Plant workers who do not operate or maintain equipment perform a variety of other tasks. Some drive trucks to make deliveries to other parts of the plant; some load and unload trucks and railroad cars; others keep inventory records. The industry also employs service workers, such as guards, cooks, and janitors, whose duties are similar to those of such workers in other industries.

Training, Other Qualifications, and Advancement

Training requirements for jobs in the drug industry range from a few hours of on-the-job training to years of formal educational preparation plus job experience. Because quality control is of paramount importance, the drug industry places a heavy emphasis on continuing education for employees, and many firms provide classroom training in safety, environmental and quality controls, and other areas.

For production and maintenance occupations, drug manufacturers generally hire inexperienced workers and train them on the job; high school graduation is not essential but generally is preferred by most firms. Beginners in production jobs assist experienced workers and learn the operation of the processing equipment. With experience, employees may advance to more skilled jobs in their departments. Most maintenance jobs are filled by people who start as helpers to electricians, plumbers, machinists, and other craft workers.

Many companies encourage production and maintenance workers to take courses related to their jobs in local schools and technical institutes, or to enroll in correspondence courses. College courses in chemistry and related areas are particularly encouraged for highly skilled production workers who operate sophisticated equipment. Some companies reimburse the workers for part, or all, of the tuition. Skilled production and maintenance workers with leadership ability may advance to supervisory positions.

For technicians in the drug industry, methods of qualifying for jobs vary in many ways. Some technicians enter the field with a high school education and advance to jobs of greater responsibility with experience and additional formal education. However, companies increasingly prefer to hire graduates of technical institutes or junior colleges, or those who have completed college courses in chemistry, biology, mathematics, or engineering. In many firms, newly hired workers begin as laboratory helpers or aides, performing routine jobs such as cleaning and arranging bottles, test tubes, and other equipment.

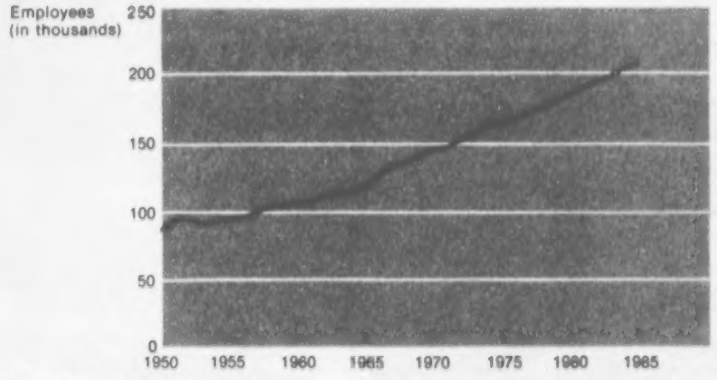
The experience required for higher levels of technician jobs varies from company to company. Generally, employees advance over a number of years from assistant technician, to technician, to senior technician, to technical associate. Some companies require senior technicians and technical associates to complete job-related college courses.

For most scientific and engineering jobs, a bachelor of science degree is the minimum requirement. Some companies have formal training programs for college graduates with engineering and scientific backgrounds. These trainees work for brief periods in the various divisions of the plant to gain a broad knowledge of drug manufacturing operations before being assigned to a particular department. In other firms, newly employed scientists and engineers are immediately assigned to a specific activity such as research, process development, production, or sales. Drug manufacturing companies prefer to hire college graduates, particularly those with strong scientific backgounds, as pharmaceutical detailers. Newly employed pharmaceutical representatives complete rigorous formal training programs revolving around their companies' product lines.

Job prospects and advancement usually are best for professionals with advanced degrees. Over half of all professionals involved in research and development have a doctoral or master's degree. Some companies offer training programs to help scientists and engineers keep abreast of new developments in their fields and to develop administrative skills. These programs may include meetings and seminars with consultants from various fields. Many companies encourage scientists and engineers to further their education; some provide financial assistance for this purpose. Publication of scientific papers also is encouraged.

Drug industry employment has shown fairly steady growth

Wage and salary workers in the drug industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Drug manufacturing employment is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to employment growth, many job openings will result from deaths, retirements, and other separations from the labor force.

The demand for drug products is expected to grow very rapidly. Demand will be stimulated primarily by population growth, particularly the growing number of older people who require more health care services, and by the growth of public and private health insurance programs, which generally cover the cost of drugs and medicine. Adoption of a national health insurance program could further expand the market for drugs. Other factors that are expected to increase the demand for drugs include greater personal income, the rising health consciousness of the general public, and the discovery of new drugs. A continued rise in foreign drug sales, particularly to developing countries with mounting health care requirements, also is anticipated.

The industry's employment will not increase as rapidly as the demand for drug products, however, because technological improvements in production methods will increase output per worker. The more widespread use of automatic processing and control equipment in operations formerly done by hand will tend to reduce labor requirements, particularly in plants where common drugs are mass-produced. For example, mixing and granulating processes, which precede tableting, have become completely mechanized in some plants. In addition, computers increasingly are used in quality control systems to eliminate computational errors in analysis and testing and to speed up production and shipment. Computers, thus, have tended to take over some of the tasks of professional, technical, and production workers.

The rate of employment growth over the last few decades is not expected to continue. Only moderate increases are anticipated in the number of scientists, engineers, and technicians engaged in pharmaceutical research and development. Increas-

ingly restrictive government regulations have reduced the rate of return on investment in research and development, and, as a result, drug manufacturers are expected to limit future expansion in this area. Demand for skilled maintenance workers (such as electricians, machinists, plumbers, and instrument repairers) will be spurred by the need to service the growing amount of automatic processing and control equipment. Employment of administrative and clerical workers is expected to increase moderately. Demand for laborers and many semiskilled plant occupations is not expected to increase significantly, as more processes are adapted to automatic equipment. However, demand for highly skilled production workers to operate the increasingly sophisticated equipment used in drug manufacturing is expected to rise.

Unlike many other manufacturing industries, drug industry employment is not highly sensitive to changes in economic conditions. Thus, even during periods of high unemployment, work is likely to be relatively stable in the drug industry.

Earnings and Working Conditions

Earnings of plant workers in the drug industry are higher than the average for all manufacturing industries. For example, in 1976, production workers in the drug industry averaged $5.50 an hour, while those in manufacturing as a whole averaged $5.19 an hour.

According to a 1973 Bureau of Labor Statistics Survey, earnings of office employees in the drug manufacturing industry were 68 percent higher than earnings for production workers. Earnings generally were highest in the North Central Region and lowest in the South. Employees generally received bonuses, vacation and sick leave, paid holidays, life, health, and accident insurance, workers' compensation, and retirement plans.

National wage data are not available for individual occupations in the drug industry. However, statements on specific occupations, such as chemist, pharmacist, and technician, found in other parts of the *Handbook*, will give general earnings information.

Some employees work in plants that operate around the clock—3 shifts a day, 7 days a week. In most plants, workers receive extra pay when assigned to second or third shifts. Since drug production is subject to little seasonal variation, work is steady.

Working conditions in drug plants are better than in most other manufacturing plants. Much emphasis is placed on keeping equipment and work areas clean because of the danger of contamination of drugs. Plants usually are air-conditioned, well-lighted, and quiet. Ventilation systems protect workers from dust, fumes, and disagreeable odors. Special precautions are taken to protect the relatively small number of employees who work with infectious cultures and poisonous chemicals. With the exception of work performed by material handlers and maintenance workers, most jobs require little physical effort. The frequency and severity of injuries in drug manufacturing has been about half the average for all manufacturing industries.

Some of the industry's production and maintenance employees are members of labor unions. The principal unions in the industry are the Oil, Chemical and Atomic Workers International Union; the International Chemical Workers Union; and United Steel Workers of America.

Sources of Additional Information

For additonal information about careers in drug manufacturing and the industry in general, write to the personnel departments of individual drug manufacturing companies and to:

Pharmaceutical Manufacturers Association, 1155 Fifteenth St. NW., Washington, D.C. 20005.

OCCUPATIONS IN THE ELECTRONICS INDUSTRY

An astronaut, a doctor, a mechanic, and a business executive all have something in common; without electronic devices they would be unable to do much of their work. We would never have reached the moon without the thousands of people working in electronics research and production. Nor would doctors be able to diagnose and treat many diseases without modern electronic machines. Mechanics use electronic testing equipment to locate malfunctioning parts in numerous types of machines and engines. Business executives also owe a lot to electronics. Electronic computers, for example, provide them with better and more information, speed up payroll and building procedures, and reduce the cost of their operations.

Nature and Location of the Industry

The electronics industry dates back to the early 1900's when the first radios were produced. By 1930, the industry had expanded its research to include, for example, the development of crude television pictures in color. It wasn't until World War II, however, that electronics production really began to diversify. Efforts to develop a wide range of military products resulted in scientific advances such as electronic measuring and detecting equipment, air flight control equipment, and the digital computer. Today, the industry produces about 30,000 types of electronic goods.

The electronics industry is divided into four main market areas: government products, industrial products, consumer products, and components. Products sold to the government make up a large portion of electronic sales and include widely different items such as missile and space guidance systems, communications systems, and other electronic goods used in medicine, education, crime detection, and traffic control. Industrial purchases include computers, radio and television broadcasting equipment, telecommunications equipment, electronic office equipment, and production control equipment—all vital to daily business operations.

Consumer products are probably the most familiar types of electronic products. Every day thousands of people buy television sets, radios, stereos, and calculators. No electronic products could be developed, however, without their main ingredient—components. Some of the most well-known components are capacitors, switches, transistors, relays, television picture tubes, and amplifiers.

About 1.4 million persons were employed in the development, pro-

Most electronics products are assembled by hand with small tools, soldering irons, and light welding machines.

duction, and sales of these products in 1976. Nearly three-quarters of them worked in plants that produce end products for government, industrial, and consumer use. The rest worked in plants that made electronic components.

Electronics manufacturing workers are located in all parts of the country, but the majority of the jobs in 1976 were in eight States: California, New York, Illinois, Massachusetts, Pennsylvania, Indiana, New Jersey, and Texas. Metropolitan areas with large numbers of electronics manufacturing workers include Los Angeles, Chicago, New York, Philadelphia, Newark, Boston, Baltimore, Indianapolis, and Dallas.

Occupations in the Industry

A wide variety of jobs exists in the electronics manufacturing industry. More than half of all workers are in plant jobs that include production, maintenance, transportation, and service occupations. The rest are scientists, engineers, and other technical workers, and administrative, clerical, and sales workers.

Professional and Technical Occupations. The electronics industry is dependent on research and development. As a result, a large proportion of its workers are in engineering, scientific, and other technical jobs. Engineers and scientists alone make up about one out of every nine electronics workers.

Scientists in the electronics industry work in a number of areas. Many are involved in pure research—learning about why and how things react the way they do. Some apply this information to develop processes or products.

Physicists work with solid-state materials. They may develop uses for semiconductors and design integrated circuits for satellites. Chemists and metallurgists work mainly in materials preparation and testing, but also work in research and development of new processes. Mathematicians and statisticians use computer models to assist engineers and scientists on complex mathematical and statistical problems, especially in the design of military and space equipment and computers. Statisticians also are employed in quality control, production scheduling, and sales analysis and planning.

Engineers use their knowledge of mathematics and science to develop new products, processes, procedures, or systems to solve problems. Electrical and electronics engineers, the largest group of engineers in the industry, work on research and development, production, and quality control problems. Most of these engineers are highly specialized and may work in a specific area such as the design and implementation of solid-state circuitry in radar, computers, and calculators.

Mechanical engineers help develop new products, tools, and equipment by setting requirements for the strength of materials and designs. They may, for example, develop calculators and television antennas. Industrial engineers determine the most efficient methods to produce these products. They evaluate plant layout, machinery, and the number and type of personnel utilized in the plant, and make suggestions to lower cost and increase production.

Chemical, metallurgical, and ceramic engineers also work for electronics companies. Chemical engineers may design chemical plants and processes while metallurgical engineers determine the most efficient way to use metals in the company's products.

Industrial designers design the exteriors of electronic products. When designing a television set, for example, they must insure that all components fit, that the set is easy to use and repair, and that it is attractive enough to compete with others on the market.

Technicians—such as electronics technicians, drafters, engineering aides, laboratory technicians, and mathematical assistants—make up about 1 out of every 20 electronics manufacturing workers. Many electronics technicians help engineers design and build experimental models. They also set up and repair electronic equipment for customers. Other electronics technicians do complex inspection and assembly work. Drafters prepare detailed drawings from sketches or specifications furnished by engineers that show the exact dimensions of the entire object and its parts.

Engineering aides assist engineers by making calculations, sketches, and drawings, and testing electronic components and systems. Laboratory technicians help physicists, chemists, and engineers in laboratory analyses and experiments. Mathematical assistants follow procedures outlined by mathematicians to solve problems. They also operate test equipment to develop computers and other electronic products.

Technical writers prepare training and technical manuals that describe the operation and maintenance of electronic equipment. They also prepare catalogs, product literature, and contract proposals. Technical illustrators draw pictures of electronic equipment for technical publications and sales literature.

Administrative, Clerical, and Related Occupations. About one out of four workers in electronics manufacturing has an administrative or other office job. Administrative workers include purchasing agents, sales executives, personnel specialists, advertising workers, and market researchers. Secretaries, typists, and business machine operators are among the thousands of other office workers employed by electronics firms. A growing proportion of these office workers operate computers.

Plant Occupations. About half of electronics manufacturing employees work in plant operations: assembly, capacitor and coil winding, inspecting, machining, fabricating, processing, and maintenance.

Assembly Occupations (D.O.T. 729.884, 720.884, 726.781 and .884). Assemblers, most of whom are semiskilled workers, make up the largest group of employees. Most end products are assembled by hand with small tools, soldering irons, and light welding machines. Assemblers use diagrams to guide their work. Some assembly is done by following instructions presented on color slides and tape recordings. Color slide projectors flash a picture of an assembly sequence on a screen, while the as-

About half of electronics manufacturing employees work in plant occupations.

sembler listens to recorded directions.

Precision assemblers and electronics technicians install components and subassemblies in complex products such as missiles. They also help make experimental models. Most of these workers are employed in the manufacture of military and industrial electronic equipment.

Machines are used in some assembly work. For example, in putting together circuit boards, automatic machines often are used to position components on boards and to solder connections. Here the assemblers work as machine operators or loaders. Most components are put together by machines, since their assembly involves simple and repetitive operations. Even some types of miniaturized semiconductors and other components, made with parts small enough to pass through a needle's eye, are assembled by machines.

Hand assembly is needed for some items, such as receiving tubes and some types of resistors and diodes. Hand assemblers may perform only a single operation as components move down the production line, but some put together complete components. Tiny parts often are assembled under magnifying lenses or microscopes. Precision welding equipment may be used to weld connections in microminiature components and circuit assemblies.

Machining Occupations. Machining workers are needed in most electronics manufacturing plants, particularly for military, space, and industrial products. Machine-tool operators and machinists make precise metal parts. Toolmakers construct and repair jigs and fixtures that hold metal while it is being stamped, shaped, or drilled. Diemakers build metal forms (dies) used in stamping and forging metal.

Fabricating Occupations. Fabricating workers are employed in many electronics manufacturing plants, but most are in plants that make industrial products. Sheet-metal workers make frames, chassis, and cabinets. *Glass blowers* and *glass lathe operators* (D.O.T. 674.782) make tubes for experimentation and development work.

In electron tube manufacturing, special fabricating workers are employed. For example, *grid lathe operators* (D.O.T. 725.884) wind fine wire around two heavy parallel wires to make grids (devices in tubes that control the flow of electrons). Other fabricating workers include *coil winders* (D.O.T. 724.781 and .884), *crystal grinders* and *finishers* (D.O.T. 726.884), and *punch press operators* (D.O.T. 617.885).

Processing Occupations. Many electronics workers process or prepare parts for assembly. *Electroplaters* and *tinners* (D.O.T. 501.885) coat parts with metal; *anodizers* (D.O.T. 501.782) treat these parts in electrolytic and chemical baths to prevent corrosion. Other processing workers also coat electronic components with waxes, oils, plastics, or other materials. Some operate machines that encase microminiature components in plastic. *Silk screen printers* (D.O.T. 726.887) print patterns on circuit boards and on parts of electronic components. *Etching equipment operators* (D.O.T. 590.885) do chemical etching of copper on circuit boards.

Operators of infrared ovens and hydrogen furnaces (D.O.T. 590.885) remove moisture and foreign deposits from ceramic, metal, and glass parts. In tube manufacturing, *exhaust operators* (D.O.T. 725.884) and *sealers* (D.O.T. 692.885) operate gas flame machines that clear tubes of impurities, exhaust the gas, and seal the tubes.

Inspection Occupations. Inspection begins when raw materials enter the plant and continues through manufacturing. Some inspection jobs require electronics technicians who have years of experience. These jobs are commonly found in complex production work such as the manufacture of computers and spacecraft. Most inspectors, however, do not need extensive technical training.

Some inspectors check incoming parts and components supplied by other firms. They may have job titles that indicate the work they do, such as incoming materials inspector or plating inspector.

During manufacturing, components are either checked manually by workers using test meters or routed mechanically through automatic test equipment. Although many of these workers simply are called testers,

others have job titles that reflect the type of components they inspect, such as transformer-tester or coil-tester. Some automatic equipment can check components, produce a punched tape of the results, and sort the components into batches for shipping. Workers who feed or monitor automatic equipment often are called test-set operators or testing-machine operators.

Electronic assembly inspectors (D.O.T. 722.281) examine assembled products to make certain that they conform to blueprints and specifications. They inspect wiring, electrical connections, and other critical items to make sure everything will work properly.

Maintenance Occupations. Many workers repair and maintain machinery and equipment. Skilled electricians are responsible for the proper operation of electrical equipment; machine and equipment repairers make mechanical repairs; maintenance machinists and welders build and repair equipment and fixtures. Air-conditioning and refrigeration mechanics work in air-conditioned plants that have special refrigerated and dust free rooms to protect sensitive parts. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers also are employed in electronics plants.

Other Plant Occupations. Many workers move and handle materials. Forklift operators stack crates in warehouses, and load and unload trucks and boxcars. Truckdrivers move freight outside the plant. The industry also employs guards and janitors.

(Detailed discussions of professional, technical, mechanical, and other occupations, found not only in electronics manufacturing plants, but also in other industries, are presented elsewhere in the *Handbook* in sections covering the individual occupations.)

Training, Other Qualifications, and Advancement

Training requirements for jobs in electronics manufacturing plants range from a few hours of on-the-job training to years of specialized preparation. Beginning engineering jobs usually are filled by recent college graduates, but some positions call for advanced degrees. A small number of workers without college degrees, however, are upgraded to professional engineering classifications from occupations such as engineering assistant and electronics technician. Workers who become engineers in this way usually take advanced electronics courses in night school or in other training programs. To keep up with new developments and to qualify for promotion, professional and technical personnel obtain additional training, read technical publications, and attend lectures and technical demonstrations.

Almost all mathematicians, physicists, and other scientists employed in electronics manufacturing have college degrees; most have advanced degrees.

Technicians generally need specialized training to qualify for their jobs. Most electronics technicians attend either a public, private, or Armed Forces technical school. Some complete 1 or 2 years of college in a scientific or engineering field, and some receive training through a 3- or 4-year apprenticeship program. High school graduates who have had courses in mathematics and science are preferred for apprenticeship programs.

Some workers advance to electronics technician positions from jobs such as tester or laboratory assistant. A relatively small number of plantworkers become technicians. Opportunities for advancement are improved by taking courses either in company-operated classes, night school, junior college, or technical school, or by correspondence.

Electronics technicians need good color vision, manual dexterity, and good eye-hand coordination. Some technicians who test radio transmitting equipment must hold licenses from the Federal Communications Commission as first- or second-class commercial radio-telephone operators.

Drafters usually take courses in drafting at a trade or technical school; a few have completed a 3- or 4-year apprenticeship. Under an informal arrangement with their employers, some qualify for both on-the-job training and part-time schooling. Because many drafters in this industry must understand the basic principles of electronic circuits, they should study basic electronic theory.

Technical writers must have a flair for writing and usually are required to have some technical training. Employers prefer to hire those who have had some technical institute or college training in science or engineering. Many, however, have college degrees in English or journalism and receive their technical training on the job and by attending company-operated evening classes. Technical illustrators usually have attended art or design schools.

Many tool and diemakers, machinists, electricians, and other craft workers learn their trades by completing a 4- or 5-year apprenticeship; others are upgraded from helpers' jobs.

Formal training is not necessary for workers entering plant jobs, but a high school diploma or its equivalent is sometimes required. Job applicants may have to pass aptitude tests and demonstrate skill for particular types of work. A short period of on-the-job training generally is provided for inexperienced workers. Assemblers, testers, and inspectors need good vision, good color perception, manual dexterity, and patience.

Requirements for administrative and other office jobs are similar to those in other industries. Some beginning administrative jobs are open only to college graduates with degrees in business administration, law, accounting, or engineering. For clerical jobs, employers usually prefer high school graduates with training in stenography, typing, bookkeeping, and office machines.

Employment Outlook

Employment growth patterns will vary among the different sectors of the industry. While employment in some areas is expected to grow faster than the average for all industries through the mid-1980's, employment in other areas either will grow more slowly or possibly decline. In addition to the jobs resulting from em-

ployment growth, large numbers of openings will arise in all areas as experienced workers retire, die, or take jobs in other industries.

Production of industrial electronic products will increase as business executives buy more computers and other electronic equipment to automate paper work and production processes. Business spending for electronic communication and testing equipment also will grow. Although the demand for television receivers, video tape recorders, stereo systems, calculators, and two-way car radios will rise as population and personal incomes grow, the increasing level of imports may adversely affect production. As a result, employment in this industry may decline. Government purchases for defense will continue to account for a large proportion of electronics manufacturing output. An increasing share of government purchases, however, is likely to be for electronic equipment used in medicine, energy conservation, education, and pollution abatement.

Employment in the electronics industry may fluctuate from year to year, because of changes in economic activity and defense spending. As a result, job openings may be plentiful in some years, scarce in others.

The rates of employment growth also will vary among occupational groups and individual occupations. For example, employment of skilled maintenance workers and service technicians is expected to rise at a more rapid rate than total employment because of the need to repair the increasing amounts of complex machinery used to produce goods, or sold to consumers. On the other hand, employment of assemblers probably will rise at a slower rate because of the growing mechanization and automation of assembly-line operations.

Employment of engineers, scientists, and technicians is expected to increase faster than total employment, because of continued high expenditures for research and development and the manufacture of more complex products. Among professional and technical workers, the greatest demand will be for engineers, particularly those who have a background in certain specialized fields, such as quantum mechanics, solid-state circuitry, product design, and industrial engineering. Many opportunities also will be available for engineers in sales departments because the industry's products will require sales personnel with highly technical backgrounds. The demand for mathematicians and physicists will be particularly good because of expanding research in computer and laser technology.

Earnings and Working Conditions

As shown in the accompanying table, in 1976 electronics production workers who made products for government and industrial use had higher average hourly earnings than production workers in manufacturing as a whole. Those making other electronic products, however, made less than the average for all manufacturing industries.

Type of product	*Production workers' average hourly earnings, 1976*
All manufacturing industries	$5.19
Major electronics manufacturing industries:	
Government and industrial electronics end products	6.45
Radio and television receiving sets, and phonographs	4.51
Electron tubes	5.22
Semiconductors and other components, except tubes	3.97

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants usually are well-lighted, clean, and quiet. Many plants are relatively new, and are located in suburban and semirural areas. The work in most occupations is not strenuous but assembly-line jobs may be monotonous.

The injury rate in electronics manufacturing has been far below the average in manufacturing as a whole, and injuries usually have been less severe.

Many workers in electronics manufacturing are union members. The principal unions are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists and Aerospace Workers; and the United Electrical, Radio and Machine Workers of America (Ind.).

Sources of Additional Information

Information about careers in this field can be obtained from the public relations departments of electronics manufacturing companies, the unions previously listed, and from:

Electronic Industries Association, 2001 Eye St. NW., Washington, D.C. 20006.

OCCUPATIONS IN FOUNDRIES

Metal castings produced by foundry workers are essential parts of thousands of products ranging from missiles to cooking utensils. The strength of metal that has been cast makes it suitable for many household and industrial items, and the development of improved alloys, or combinations of metals, has widened the range of products made by casting.

In 1976, about 300,000 people worked in the foundry industry producing bath tubs, tubing, plumbing fixtures, and thousands of other products. Thousands of other workers were employed in the foundry departments of other industries that make castings to use in their final product, such as crank shafts and engine blocks for automobiles and compressors for refrigerators.

Casting is a method of forming metal into intricate shapes. To cast metal, a mold is created that has a cavity exactly shaped like the object to be produced. Molten metal, usually iron, is poured into the mold where it cools and solidifies.

Nature and Location of the Foundry Industry

Nearly three-fourths of the foundry industry's employees work in iron and steel foundries. The remainder work in plants that cast nonferrous metals, such as aluminum, bronze, and zinc. Foundries usually specialize in a limited number of metals, because different methods and equipment are needed to melt and cast different alloys.

There are six principal methods of casting, each named for the type of mold used. In the most common method, green-sand molding, a special sand is packed around a pattern in a boxlike container called a flask. The pattern is withdrawn and molten metal is poured into the mold cavity to form the desired shape. Because sand molds can be used only once, a second method, called permanent molding, was developed which employs a metal mold that can be used many times. Permanent molding is used chiefly for casting nonferrous metals.

Precision investment casting, a third method (often called the lost wax process), uses ceramic molds. A wax or plastic pattern is coated with clay; after the coating hardens, the wax or plastic is melted and drained so that a mold cavity is left. Unlike the first two methods, castings produced from these molds are precise and require little finishing.

Shell molding, a fourth process, is becoming increasingly important because castings produced from these molds not only are precise but also have a smooth surface that requires almost no finishing. In this method, a heated metal pattern is covered with a mixture of sand and resin. The sand forms a thin shell mold that, once hardened, is peeled from the pattern.

Diecasting, a fifth process, is done mostly by machines. Dies are impressions that are carved by machines into metal blocks or plates. Molten metal is forced under high pressure into dies from which the castings are later automatically ejected or removed by hand.

A sixth method, centrifugal casting, is used to make pipe and other products that have cylindrical cav-

Supervisor inspects cores.

ities. In this process, molten metal is poured into a mold that is spinning at a very high speed. The spinning motion forces the metal against the walls of the mold where it then hardens.

Most foundries are small. More than 90 percent employ fewer than 250 workers, although several of the largest employ more than 5,000 workers.

Small foundries generally produce a variety of castings in small quantities. They employ hand and machine molders and coremakers (the key foundry occupations) and a substantial number of unskilled laborers. Large foundries often are highly mechanized and produce great quantities of identical castings. These shops employ relatively few unskilled laborers because cranes, conveyors, and other types of equipment replace manual labor in the moving of materials, molds, and castings. Since much of the casting in large shops is mechanized, they also employ proportionately fewer skilled molders and coremakers than small shops. However, many skilled maintenance workers, such as millwrights and electricians, are employed to service and repair the large amount of machinery.

Though foundries are located in many areas, jobs are concentrated in States that have considerable metalworking activity, such as in Michigan, Ohio, Pennsylvania, Illinois, Indiana, and Wisconsin.

Employees placing cores into molds.

Foundry Occupations

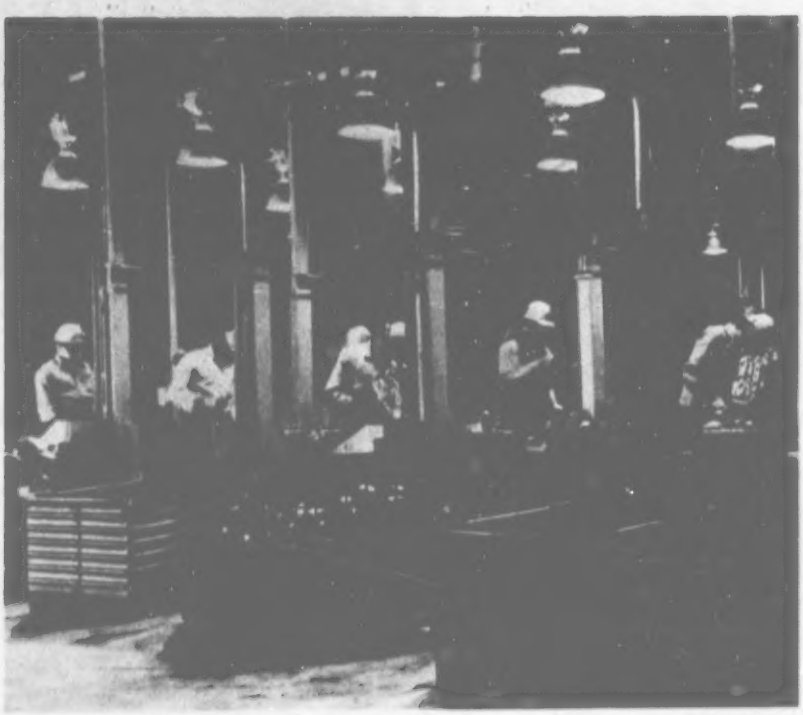
Most of the industry's 300,000 employees in 1976 were plant workers. To illustrate more clearly the duties of these workers, a brief description of the jobs involved in the most common casting process—sand molding—follows:

After the casting is designed, a *patternmaker* (D.O.T. 600.280 and 661.281), following the design blueprint, makes a wood or metal pattern in the shape of the casting. Next, a *hand molder* (D.O.T. 518.381) makes sand molds by packing and ramming sand, specially prepared by a *sand mixer* (D.O.T. 579.782), around the pattern. A *molder's helper* (D.O.T. 519.887) may assist in these operations. If large numbers of identical castings are to be made, machines may be used to make the molds at a faster speed than is possible by hand. The operator of this equipment is called a *machine molder* (D.O.T. 518.782).

A *coremaker* (D.O.T. 518.381 and .885) shapes sand into cores (bodies of sand that make hollow spaces in castings). *Core-oven tenders* (D.O.T. 518.885) bake most cores in ovens to harden and strengthen them so that they can be handled without breaking. When a sufficient number of cores are assembled, they are placed in the molds by *core setters* (D.O.T. 518.884) or molders. Now the molds are ready for the molten metal.

A *furnace operator* (D.O.T. 512.782) controls the furnace that melts the metal which a *pourer* (D.O.T. 514.884) lets flow into molds. When the castings have solidified, a *shakeout worker* (D.O.T. 519.887) removes them from the sand and sends them to the cleaning and finishing department.

Dirty and rough surfaces of castings are cleaned and smoothed. A *shotblaster* (D.O.T. 503.887) operates a machine that cleans large castings by blasting them with air mixed with metal shot or grit. Smaller castings may be smoothed by tumbling. In this process, the castings, together with sand or another abrasive material, are placed in a barrel that is rotated at high speed. The person who controls the barrel is called a *tumbler operator* (D.O.T. 599.885). Sandblasters and tumbler operators may also operate a machine that both tumbles and blasts the castings. A *chipper* (D.O.T. 809.884) and a *grinder* (D.O.T. 809.884) use pneumatic chisels, power abrasive wheels,



Grinders finishing castings.

powersaws, and handtools, such as chisels and files, to remove excess metal and to finish the castings.

Castings frequently are heat-treated in furnaces to strengthen the metal; a *heat treater*, or *annealer* (D.O.T. 504.782), operates these furnaces. Before the castings are packed for shipment, a *casting inspector* (D.O.T. 514.687) checks them to make sure they are structurally sound and meet specifications. Often, the inspection involves X-raying the casting to check for separations in the metal.

Many foundry workers are employed in occupations that are common to other industries. For example, maintenance mechanics, machinists, carpenters, and millwrights maintain and repair foundry equipment. Crane and derrick operators and truckdrivers move materials from place to place. Machine tool operators finish castings. Foundries also employ thousands of workers in unskilled jobs, such as guard, janitor, and laborer.

About one-sixth of all foundry workers are employed in professional, technical, administrative, clerical, and sales occupations. Of these personnel, the largest number are clerical workers, such as secretaries, typists, and accounting clerks.

Foundries employ engineers and metallurgists to do research, design machinery and plant layout, develop improved alloys, control the quality of castings, and supervise plant operations and maintenance. In recent years, many of these workers have been hired to sell castings and to assist customers in designing cast parts. Most foundry technicians are concerned with quality control. For example, they may test molding and coremaking sand, make chemical analyses of metal, and operate machines that test the strength and hardness of castings. Administrative workers employed in foundries include office managers, personnel workers, purchasing agents, and plant managers.

Detailed discussions of three principal foundry occupations—patternmakers, coremakers, and molders—appear elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most workers start in unskilled jobs, such as laborer or helper, and, after receiving on-the-job training from a supervisor or experienced worker, gradually learn more skilled jobs. This is the usual practice in training workers for casting process jobs such as melter, chipper, and grinder.

Some skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. Apprentices receive supervised on-the-job training for 2 to 4 years, usually supplemented by classroom instruction. High school graduates are preferred for most apprenticeship programs, but applicants with less education sometimes are hired. For some apprenticeship programs, especially those for patternmaking, a high school education is the minimum requirement. Management prefers workers who have completed an apprenticeship, because they have a greater knowledge of all foundry operations and therefore are better qualified to fill supervisory jobs.

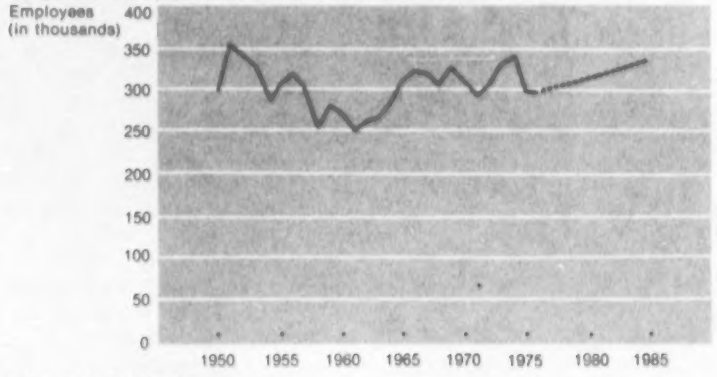
Skilled foundry workers also can learn their trades informally on the job or through a combination of trade school and on-the-job training. In some cases, trade school courses may be credited toward completion of formal apprenticeships. Some foundries and the American Foundry Society Cast Metals Institute conduct training programs to update and upgrade the skills of experienced workers.

Employment Outlook

Over the long run, population growth and higher incomes will create a demand for more automobiles, household appliances, and other consumer products that have cast parts. More castings also will be needed for industrial machinery as factories expand and modernize. Despite the increasing demand for castings, employment in the foundry industry is expected to grow only about as fast as the average for all industries through the mid-1980's. Technologi-

Employment in foundries is very sensitive to year-to-year fluctuations in the business cycle

Wage and salary workers in foundries, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

cal developments will enable foundries to meet the increased demand for castings with only a moderate increase in employment. Continued improvements in production methods will result in greater output per worker. In addition to those job openings that result from employment growth, many other openings will arise due to the need to replace experienced workers who die, retire, or transfer to other fields of work. The number of openings fluctuates greatly from year to year, since demand for castings is very sensitive to ups and downs in the economy.

Much of the employment increase in the foundry industry will be in production jobs. However, employment will increase in other occupations, as well. For example, employment of scientists and engineers is expected to increase because of expanding research and development activities. Technicians also will be needed in greater numbers to help improve quality control and production techniques. More maintenance workers will be hired to keep the industry's growing amount of machinery in working order. In contrast, machine molding and coremaking will be substituted for hand processes, and will limit the need for additional hand molders and hand coremakers. Improved molding techniques, such as quick set molding in which the mold hardens quickly and without baking in an oven, also will limit employment of molders. As more machinery for materials handling is introduced, employment of laborers and other unskilled workers may decline.

Earnings and Working Conditions

Production workers in foundries have higher average earnings than those in manufacturing as a whole. In 1976, production workers in iron and steel foundries averaged $6.16 an hour, and those in nonferrous foundries averaged $5.22. By comparison, production workers in all manufacturing industries averaged $5.19 an hour.

Most foundry industry employees work under union contracts that provide periodic pay increases. In those foundries that operate 24 hours a day, 7 days a week, contracts generally provide for extra pay for shift work and work done on weekends and holidays. Also, most contracts provide paid vacations according to length of service. Typically, an employee receives 1 week of vacation after 1 year of service, 2 weeks after 2 years, and 3 weeks after 10 years. In addition, many employees are covered by paid sick leave plans, group insurance, accident and death benefits, and retirement and disability pensions.

Working conditions in foundries have improved in recent years. Many foundries have changed plant layouts and installed modern ventilating systems to reduce heat, fumes, dust, and smoke. The injury rate in foundries is higher than the average for manufacturing; foundry workers are subject to burns from hot metal and cuts and bruises from handling metal castings. However, employers and unions are attempting to reduce injuries by promoting safety training.

Foundry workers belong to many unions, including the International Molders' and Allied Workers' Union; the United Steelworkers of America; and the International Union of Electrical, Radio and Machine Workers. Many patternmakers are members of the Pattern Makers' League of North America.

Sources of Additional Information

Further information about work opportunities in foundry occupations may be obtained from local foundries, the local office of the State employment service, the nearest office of the State apprenticeship agency, or the Bureau of Apprenticeship and Training, U.S. Department of Labor. Information also is available from the following organizations:

American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill. 60016.

Foundry Educational Foundation, 1138 Terminal Tower, Cleveland, Ohio 44113.

International Molders' and Allied Workers' Union, 1225 E. McMillan St., Cincinnati, Ohio 45206.

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

Industrial chemical products are the raw materials for all kinds of everyday items, from nylon stockings to automobile tires. Chemicals also are used to treat drinking water, to propel rockets, and to make steel, glass, explosives, and thousands of other items. The discovery of nylon, plastics, and other new products has helped the industrial chemical industry become one of the Nation's most important.

Making these many, very different kinds of products requires a large number of workers with many different skills. About 540,000 people in many different occupations worked in the industrial chemical industry in 1976. Training varies from a few days on the job for some plant-workers to college degrees for engineers and chemists.

Nature of the Industry

The industry produces organic and inorganic chemicals, plastics, and synthetic rubber and fibers. Unlike drugs, paints, and other chemical products sold directly to consumers, industrial chemicals are used by other industries to make their own products.

Chemical products are made from coal, petroleum, limestone, mineral ores, and many other raw materials. Since these materials usually go through several chemical changes, the finished products are vastly different from the original ingredients. Some plastics, for example, are made from natural gas.

In a modern chemical plant, electronic and other automated equipment controls the dissolving, heating, cooling, mixing, filtering, and drying processes that convert raw materials to finished products. This equipment regulates the combination of ingredients, flow of materials, and the temperature, pressure, and processing time. Materials also are moved automatically from one part of the plant to another by conveyors or through pipes. Through the use of such automated equipment, a relatively small number of workers can produce tons of chemicals in one continuous operation.

About two-thirds of the 3,000 industrial chemical plants in the United States have fewer than 50 workers. Over half of the industry's employees, however, are concentrated in large plants with more than 500 workers.

Chemical plants are usually close to manufacturing centers or near the sources of raw material. Many plants that produce chemicals from petroleum, for example, are near the oil fields of Texas and Louisiana. Although industrial chemical workers are employed in almost every State, about half of them work in Tennessee, New Jersey, Texas, Virginia, West Virginia, Ohio, and South Carolina.

Occupations in the Industry

Workers with many different skills and levels of education work in the industrial chemical industry. Research scientists, engineers, and technicians develop products and design equipment and production processes. Administrators, professionals, and clerical workers handle financial and business matters, keep records, and advertise and sell chemical products. Other employees are in processing, maintenance, and other plant jobs.

Scientific and Technical Occupations. The industrial chemical industry is one of the Nation's major employers of scientific and technical workers; 1 out of 5 of its employees is a scientist, engineer, or technician. An even larger number are administrators or production supervisors. Because the sale of chemical products frequently requires a technical background, scientists and engineers may take jobs as sales representatives.

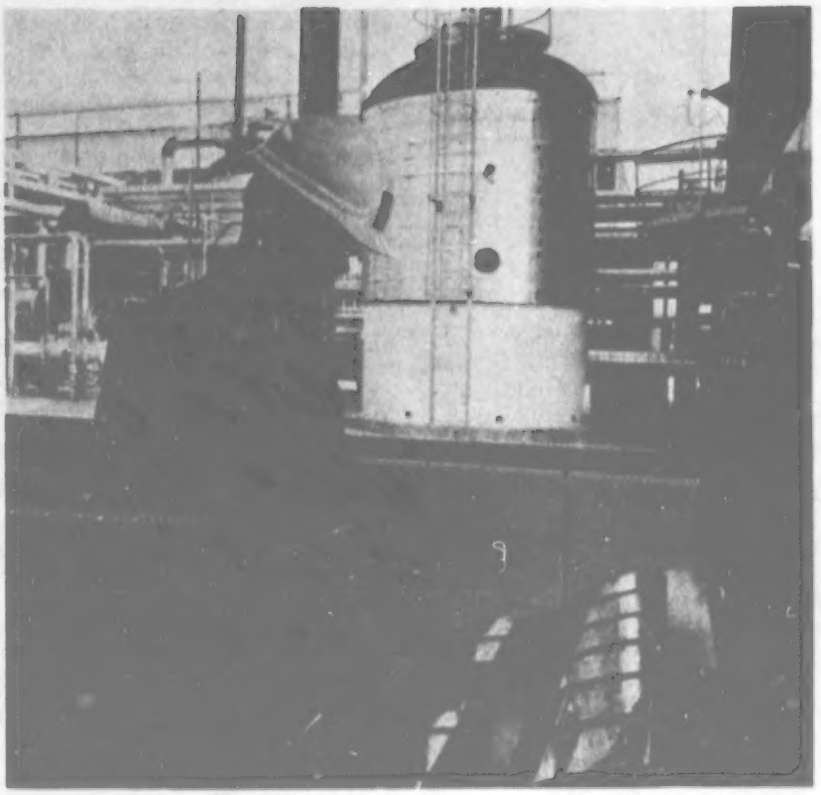
Chemists are the largest and one of the most important group of scientists in the industry. Through basic and applied research, chemists learn about the properties of chemicals in order to find new and improved products and production methods. Their efforts have led to the discovery of plastics, nylon, and many other items.

Chemists also work in activities other than research and development. A large number supervise plantworkers or analyze and test chemical samples to insure the quality of the final product. Many are administrators, marketing experts, chemical sales workers, and technical writers.

Engineers are another important group of industrial chemical professionals. Using their knowledge of both chemistry and engineering, chemical engineers convert laboratory processes into large-scale production methods. They design chemical plants and processing equipment and sometimes supervise their construction and operation. Chemical engineers also fill jobs in sales, customer service, market research, plant management, and technical writing.

Mechanical engineers design power and heating equipment. They also work with chemical engineers to design processing equipment and supervise its installation, operation, and maintenance. Electrical engineers design electric and electronic instruments and control devices, and facilities for generating and distributing electric power.

Many technical workers assist scientists and engineers. Laboratory technicians conduct tests and record the results in charts, graphs, and reports that are used by chemists and chemical engineers. Their work may range from simple routine tests to complicated analyses. Drafters provide engineers with specifications and detailed drawings of chemical equipment.



Chemical engineer monitors process at chemical plant.

Design engineer, drafter, and model builder examine model of new chemical plant layout.

Plant Occupations. About three out of every five industrial chemical workers operate or maintain equipment or do other plant jobs.

Skilled *chemical operators* (D.O.T. 558.885 and 559.782) and their helpers are the largest group of plant workers. They set dials, valves, and other controls on automatic equipment to insure that the right temperature, pressure, and amounts of materials are used. As chemicals are processed, operators read instruments that measure pressure, flow of materials, and other conditions. They also use instruments to test chemicals or send chemical samples to the testing laboratory. Operators keep records of instrument readings and test results and report equipment breakdowns. Chemical operators sometimes are called filterers, mixers, or some other title, depending on the kinds of equipment they operate.

To keep production processes running smoothly, instruments must give accurate measurements and equipment must withstand corrosion, damaging chemicals, high temperatures, and pressure. Many skilled maintenance workers are needed to keep this equipment in good condition. Pipefitters and boilermakers lay out, install, and repair pipes, vats, and pressure tanks; maintenance machinists make and repair metal parts for machinery; electricians maintain and repair wiring, motors, and other electrical equipment; and instrument repairers install and service instruments and control devices. In some chemical plants, one worker may do several of these jobs. Plant workers also are needed to drive trucks, keep inventory of stock and tools, load and unload trucks, ships, and railroad cars, keep the plant and office clean, and do many other kinds of work.

Administrative, Clerical, and Related Occupations. About one out of five industrial chemical workers holds an administrative, clerical, or other nonscientific white-collar job. High-level managers generally are trained in chemistry or chemical engineering. These executives decide what products to manufacture, where to build plants, and how to handle the company's finances. Executives depend on

specialized workers including accountants, sales representatives, lawyers, industrial and public relations workers, market researchers, computer programmers, and personnel and advertising workers. Many secretaries, typists, payroll and shipping clerks, and other clerical employees work in offices and plants.

(Individual statements elsewhere in the *Handbook* give detailed discussions of many scientific, technical, maintenance, and other occupations found in the industrial chemical industry as well as in other industries.)

Training, Other Qualifications, and Advancement

Jobs in the industrial chemical industry require from a few days of on-the-job training to many years of preparation. Some plant workers can learn their jobs in a day or two. Scientists, engineers, technicians, and chemical operators, on the other hand, spend several years learning their skills.

Industrial chemical firms generally hire and train inexperienced high school graduates for processing jobs. Equipment operators and other processing workers often start out in a labor pool where they are assigned jobs such as filling barrels or moving materials. Workers may be transferred from the labor pool to fill vacancies in one of the processing departments. Training for processing occupations is done almost entirely on the job under the supervision of an experienced worker. Workers move to jobs requiring greater skills as they gain experience and job openings occur. Thus, a worker may advance from laborer to chemical operator helper, and then to chemical operator. Skilled processing workers are rarely recruited from other plants.

Although many maintenance workers start as helpers and pick up their skills from experienced workers, apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually last 3 or 4 years and consist mainly of shop training in their particular jobs. Instrument repairers sometimes attend training programs offered by instrument manufacturers. Maintenance workers and trainees are encouraged to take job-related courses at local vocational or technical schools. Their employers may pay part or all of the tuition.

Technicians qualify for their jobs in many ways. Graduates of technical institutes, junior colleges, or vocational technical schools have the best opportunities. Companies also hire students who have completed part of the requirements for a college degree, especially if they have studied mathematics, science, or engineering. High school graduates with courses in chemistry can qualify through on-the-job training and experience. Many technicians receive additional technical school or undergraduate training through company tuition-refund programs.

Laboratory technicians usually start as trainees or assistants, and drafters begin as copyists or tracers. As they gain experience and show ability to work without close supervision, these technicians advance from routine work to more difficult and responsible jobs.

Engineers and scientists must have at least a bachelor's degree in engineering, chemistry, or a related science. Most research jobs, however, require advanced degrees or specialized experience. Many scientists and engineers attend graduate courses at company expense.

Some firms have formal training programs for newly hired scientists and engineers. Before they are assigned to a particular job, these employees work briefly in various departments to learn about the company's overall operation. In other firms, junior scientists and engineers are assigned immediately to a specific job.

Chemists and engineers as well as people with college degrees in business administration, accounting, economics, statistics, marketing, and industrial relations, often advance to administrative jobs. Some companies have advanced training programs for new administrative employees. Persons with a technical background in chemistry or engineering will have the best opportunities for sales positions.

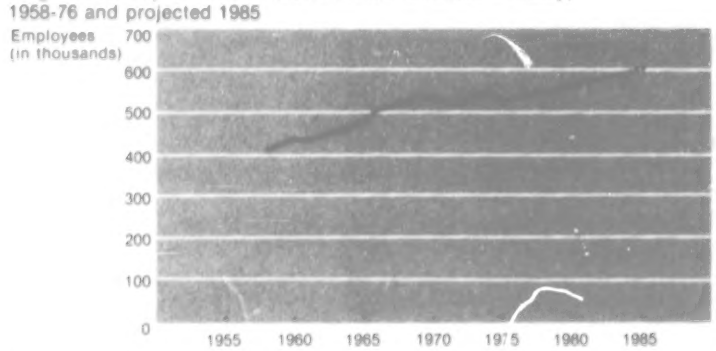
Secretaries, bookkeepers, and other clerical workers generally have had commercial courses in high school or business school.

Employment Outlook

Employment in the industrial chemical industry is expected to grow more slowly than the average for all industries through the mid-1980's. Most job openings will occur

Continued long-term growth is expected in the industrial chemical industry, despite some sensitivity to the business cycle

Wage and salary workers in the industrial chemical industry, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

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from the need to replace experienced workers who retire, die, or transfer to other industries.

However, continued emphasis on research and development is expected to stimulate some growth in the industrial chemical industry, which has far outstripped most other major industries in the development of new products. Some of these products, such as plastics and synthetics, not only have created new markets but also have competed successfully in markets previously dominated by woods, metals, and natural textiles. Chemical products are expected to continue to make advances in these markets. However, higher production costs may cause the growth rate in the production of industrial chemicals to slow down in the future. Firms are expected to pay more for petroleum and natural gas, which are the raw materials for many industrial chemicals. In addition, more stringent air and water quality standards are forcing chemical companies to spend more money for pollution control equipment.

Employment is expected to grow at a slower rate than production because of laborsaving technological developments and the greater use of automatic processing and control equipment. Although the composition of employment in the industry is expected to change, with more administrative and technical workers needed to handle the increasingly complex production processes, most job openings will be for production workers since they are the largest group of employees.

Earnings and Working Conditions

Production workers in the industrial chemical industry have relatively high earnings because a large proportion of them are in skilled jobs. In 1976 they averaged $6.21 an hour, compared with $4.87 an hour for production workers in all industries.

National wage data are not available for individual occupations in the industrial chemicals industry. However, specified in 1976 hourly wages in a few union-management contracts were as follows:

	Hourly rates
Instrument repairers	$4.93–5.30
Laboratory technicians	4.82–7.07
Chemical operators	4.64–6.90
Pipefitters, boilermakers, and sheet-metal workers	4.98–7.95

Because chemical plants usually operate around the clock—three shifts a day, 7 days a week—processing workers often work the second or third shift, usually for extra pay. Shift assignments are usually rotated, so an individual may work days 1 week and nights the next. Maintenance workers usually work only the day shift.

Most industrial chemical jobs, except those for laborers or material handlers, are not strenuous. Equipment operators are on their feet most of the time. Some workers must climb stairs or ladders to considerable heights, or work outdoors in all kinds of weather. Workers may be exposed to dust, disagreeable odors, or high temperatures, although many plants have ventilating or air-conditioning systems.

Many chemicals are dangerous to touch or breathe. However, the industrial chemical industry has one of the better safety records in manufacturing. Protective clothing, eyeglasses, showers, eye baths near hazardous work stations, and other safety measures help prevent serious injuries.

Many production workers in the industrial chemical industry belong to labor unions, including the International Chemical Workers Union; Oil, Chemical, and Atomic Workers International Union; and the United Steelworkers of America.

Sources of Additional Information

Further information on careers in the industry may be obtained from employment offices of industrial chemical companies, locals of the unions mentioned above, and from:

American Chemical Society, 1155 16th St. NW., Washington, D.C. 20036.

Manufacturing Chemists' Association, Inc., 1825 Connecticut Ave. NW., Washington, D.C. 20009.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

Steel is the backbone of any industrialized economy. Few products in daily use are not made from steel or processed by machinery made of steel. For example, steel sheets are made into automobile bodies, appliances, and furniture; steel bars are used to make parts for machinery and to reinforce concrete in building and highway construction; steel plates become parts of ships, bridges, railroad cars, and storage tanks; strip steel is used to make pots and pans, razor blades, and toys.

To satisfy the country's need for steel, the iron and steel industry employed about 540,000 persons in 1976. Employees work in a broad range of jobs that require a wide variety of skills; many of these jobs are found only in iron and steelmaking.

Characteristics of the Industry

The iron and steel industry, as discussed in this chapter, consists of the firms that operate blast furnaces, steel furnaces, and finishing mills. Blast furnaces make iron from iron ore, coke, and limestone. Steel furnaces refine the iron and scrap steel into steel. Primary rolling mills and continuous casting operations shape the steel into semifinished products called blooms, billets, and slabs, which other rolling mills shape into steel sheets, bars, plates, strips, wire, pipe, and various other finished products.

The types of operations performed in the more than 900 steel plants in the United States vary throughout the industry. Fully integrated steel plants, which are so large they may cover several square miles, contain blast furnaces, steel furnaces, and rolling mills. These plants perform all the operations necessary to convert processed iron ore into finished steel products. Other plants only perform finishing operations such as making steel wire and pipe from billets.

The number of people employed in the plants of the iron and steel industry also varies greatly. Individual plants typically employ a large number of workers because the production of iron and steel products is a monumental task. It requires the handling and use of thousands of tons of raw materials, and involves enormous facilities and equipment such as blast furnaces that may be 12 stories high and rolling mills that may be several city blocks long. About 65 percent of the industry's employees work in plants that have more than 2,500 employees; fully integrated plants may have more than 10,000. Many plants, however, have fewer than 100 employees.

Iron and steel plants are located mainly in the northeastern part of the United States near the abundant iron deposits of the Great Lakes area and the nearby coal deposits. About 7 out of 10 of the industry's workers are employed in five States—Pennsylvania, Ohio, Indiana, Illinois, and New York. Nearly 3 out of 10 are employed in Pennsylvania alone. The largest steel-producing plants are located in Indiana Harbor and Gary, Ind.; Sparrows Point, Md. (near Baltimore); Chicago; and Pittsburgh.

Occupations in the Industry

Workers in the iron and steel industry hold more than 2,000 different types of jobs. About 80 percent of all workers are directly engaged in moving raw materials and steel products about the plants, making iron and steel products, and maintaining the vast amount of machinery used in the industry. In addition, other workers are needed to do clerical, sales, professional, technical, administrative, and supervisory work.

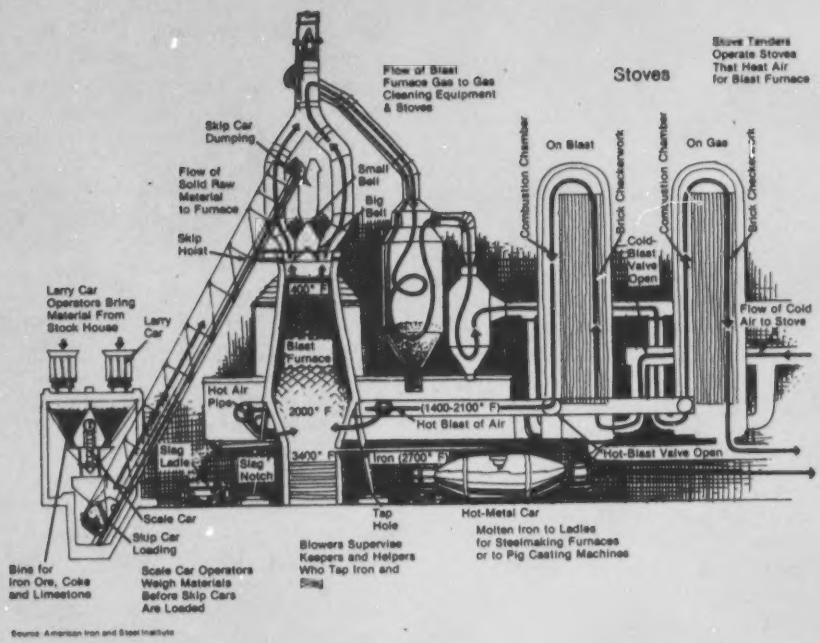
Processing Occupations. The majority of the workers in the industry are employed in the many processing operations involved in converting iron ore into steel and then into semifinished and finished steel products. Because of the extensive use of automated control equipment in making steel from iron ore, most processing jobs are found in the rolling mills where the steel is shaped into semifinished and finished products. Following are brief descriptions of the major iron and steelmaking and finishing operations and some of the occupations connected with them.

Blast furnaces. The blast furnace, a large steel cylinder lined with heat-resistant (refractory) brick, is used to separate the iron from other elements in the iron ore. A mixture of ore, coke, and limestone (called a "charge") is fed into the top of the furnace. As this material works its way down through the furnace, hot air blown into the bottom from giant stoves causes the coke to burn at a high temperature. At this high temperature a chemical reaction takes place between the coke and the iron ore, freeing the iron from other elements in the ore.

The iron, which now is a liquid, trickles down through the burning coke and collects in a pool 4 to 5 feet deep at the bottom of the furnace. As the liquid iron passes through the coke, the intense heat causes another chemical reaction between the limestone, the burned-out coke, and any other materials to form a waste product called "slag". The slag also trickles down through the coke and floats on top of the heavier iron. In a typical furnace liquid iron is removed from the furnace every 3 or 4 hours; slag may be removed more frequently.

A blast furnace operates continuously, 24 hours a day, 7 days a week, unless it is shut down for repairs or for other reasons. A single furnace may produce up to 10,000 tons of iron in a 24-hour period.

The raw materials used in blast furnaces are transferred from storage areas on railroad cars. Moving on



Source: American Iron and Steel Institute

elevated tracks to the furnace, the cars are positioned over an open grate. The raw materials are dumped through the grate and into a large funnel-shaped bin called a hopper. *Scale car operators* (D.O.T. 921.883) drive other railroad cars on tracks in tunnels underneath the hoppers. Positioning their car under one of these bins, they fill it with raw material, weigh the loaded car, and then dump the material into skip cars where the ore, limestone, or coke is automatically carried up a steep ramp to the top of the blast furnace and dumped. Scale car operators must keep records of what they put in the furnace. In blast furnace operations without automatic controls, a *skip car operator* (D.O.T. 921.883) uses electric and pneumatic controls to operate the cars.

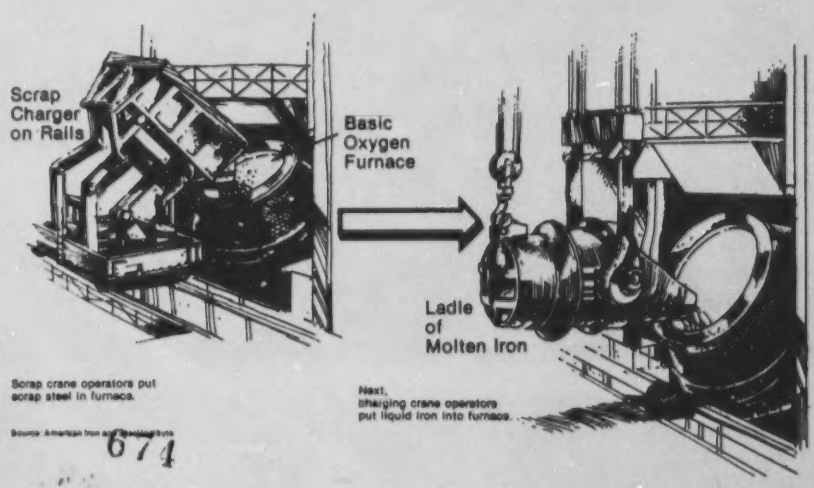
Stove tenders (D.O.T. 512.782) operate the gas-fired stoves that heat air for the blast furnace. They observe controls that show the temperature of the air inside the stove. When air reaches the correct temperature, the tender opens valves on the stove that allow the heated air to pass to the furnaces. Stove tenders also keep the stove flues clean of carbon and dirt.

Blowers (D.O.T. 519.132) oversee the operation of one or more blast furnaces and are responsible for the quantity and quality of the iron produced. They coordinate the addition of raw materials by stockhouse workers with the operation of the furnace and supervise *keepers* (D.O.T. 502.884) and their *helpers* (D.O.T. 502.887) in removing (tapping) the liquid iron and slag from the furnace. If the iron is not forming correctly in the furnace, blowers may have the stove tenders change the temperature and flow of air into the furnace.

When the blower has determined that the iron is ready to be removed, the keeper and a helper use power drills, air hoses, or small explosive charges to remove the clay that is plugging a taphole above the liquid iron, allowing the slag to flow down a sand-lined channel into huge containers called ladles, which have been positioned under the channel by crane operators. Helpers open gates to divert the slag into other ladles when the first one is filled. After removing the slag, the keeper removes the clay from a lower taphole that allows the iron to flow down another channel into special railroad tank cars called "hot metal cars".

After the slag and iron have been removed, the keeper uses a "mud gun" to shoot clay into the tapholes. The keeper and helpers use tongs to remove solidified iron and slag from the channels and shovels to line the channels with special heat-resistant sand.

Some of the iron taken from the blast furnace is made into finished products such as automobile engine blocks and plumbing pipes. Most of it, however, is used to make steel.


Scrap Charger on Rails
Basic Oxygen Furnace
Ladle of Molten Iron
Scrap crane operators put scrap steel in furnace.
Next, charging crane operators put liquid iron into furnace.

Source: American Iron and Steel Institute

Because steel is stronger than iron and can be hammered and bent without breaking, it can be used for many more products.

Steel furnaces. Steel is made by heating iron or scrap steel to remove some of the carbon and other impurities and adding chemical agents such as silicon and manganese. By varying the amount of carbon and chemical agents contained in the final product, thousands of different types of steel can be made—each with specified properties that are suited for a particular product. For example, stainless steel is rust-resistant and heat-resistant and is used in products, which need those qualities such as razor blades.

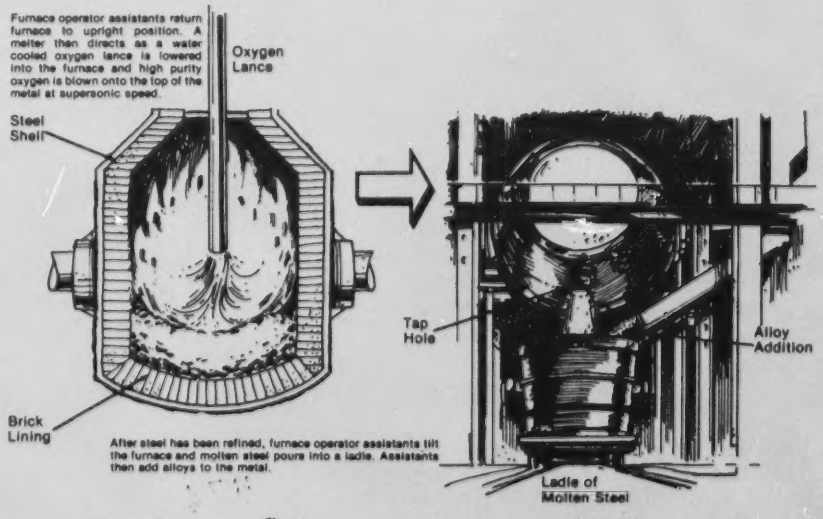
Steel is made in three types of furnaces: basic oxygen, open hearth, and electric. More than 60 percent of all domestic steel is made in basic oxygen furnaces (BOF's) and about 20 percent in open hearth furnaces. Both produce similar kinds of steel, but BOF's do the job faster and are expected to replace many of the open hearths now in operation. For many years electric furnaces were used mainly to produce high quality steels such as stainless and tool steel. They now produce large quantities of regular steel and account for about 20 percent of total U.S. steel output.

Although the steelmaking procedure varies with the type of furnace used, the jobs associated with the various processes are similar. Since basic oxygen furnaces account for most of the U.S. steel, the jobs connected with them will be used as an illustration of those in other steel furnace operations.

A *melter* (D.O.T. 512.132) supervises workers at a steel furnace. Melters receive information on the characteristics of the raw materials they will be using and the type and quality of steel they are expected to produce. The melter makes the steel according to the desired specifications by varying the proportions of iron, scrap steel, and limestone in the furnace, and by adding small amounts of other materials such as manganese, silicon, copper, or chrome. The melter directs the workers who load furnaces with these raw materials and supervises the taking of a sample of liquid steel that is tested to insure the steel has the desired qualities. The melter must coordinate the loading and melting of the raw materials with the steel molding operation to avoid delays in production.

A basic oxygen furnace is a giant, pear-shaped steel container lined with heat-resistant brick. The furnace can be tilted from side to side to receive raw materials and discharge steel and slag. The *furnace operator* (D.O.T. 512.782), under the direction of the melter, controls the operation of the furnace. To begin the operation, the furnace operator's first assistant uses controls to tilt the furnace to receive a load or "charge" of steel scrap and molten iron. A *scrap crane operator* (D.O.T. 921.883) adds scrap steel and is followed by a *charging crane operator* (D.O.T. 921.883) who adds the liquid iron made by the blast furnace. After the assistant rights the furnace, the furnace operator, who works in a control room overlooking the furnace, uses levers and buttons to lower the oxygen lance, a pipe that blows oxygen into the furnace at supersonic speeds. The furnace operator also controls the addition of lime, which combines with impurities in the iron to form slag, and the addition of any chemical agents that are required to give the steel the desired properties. If the chemical reactions in the furnace become too violent, the furnace may overheat, causing slag and iron to splash out the top. Thus, the furnace operator must pay close attention to conditions in the furnace, regulate the oxygen flow, and, if the furnace does overheat, direct the rocking of the furnace to cool it.

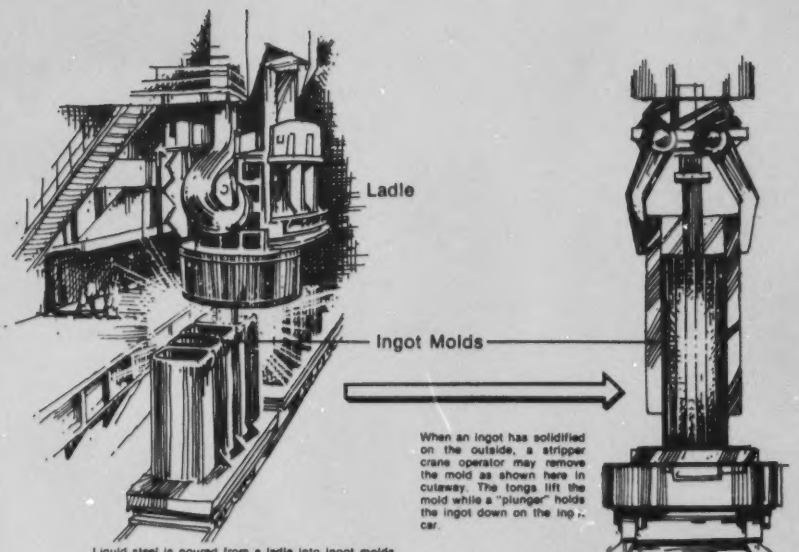
By observing the various instruments in the control room, the furnace operator knows when the steel has almost the correct composition. The first assistant then tilts the furnace while the second assistant and helpers, working from behind a heat shield, use a long-handled spoon to take a sample. The sample is sent up to the lab where metallurgists determine how close the steel is to the product desired. Based on this information, the furnace operator determines how much longer and at what temperature the furnace should operate. When the furnace operator has determined that the steel has the specified qualities, the first assistant tilts the furnace towards a waiting ladle. The steel flows through a taphole in the side of the furnace and into the ladle. The second assistant and helpers may add chemical agents to the ladle while the steel is poured. By continually tilting the furnace at a steeper angle the first assistant can


Furnace operator assistants return furnace to upright position. A melter then directs as a water cooled oxygen lance is lowered into the furnace and high purity oxygen is blown onto the top of the metal at supersonic speed.
Oxygen Lance
Steel Shell
Brick Lining
After steel has been refined, furnace operator assistants tilt the furnace and molten steel pours into a ladle. Assistants then add alloys to the metal.
Tap Hole
Alloy Addition
Ladle of Molten Steel
Source: American Iron and Steel Institute

keep the slag above the taphole, preventing it from flowing into the ladle. Eventually, the slag is poured through the taphole into the slag pot. The assistants and helpers then use handtools to clean out the taphole and furnace lip.

The liquid steel usually is solidified into large blocks called "ingots." A *hot metal crane operator* (D.O.T. 921.883) controls an overhead crane which picks up the ladle of liquid steel and moves it over a long row of iron ingot molds resting on railroad flatcars (ingot buggies). The *steel pourer* (D.O.T. 514.884) operates a stopper at the bottom of the ladle to let the steel flow into these molds. The steel pourer also examines the molds to see that they are clean and smooth and directs a helper in taking a sample of the steel for chemical analysis. As soon as the steel has solidified sufficiently, an *ingot stripper* (D.O.T. 921.883) operates an overhead crane, which removes the molds from the ingots. The steel now is ready to be shaped into semifinished and finished products.

Rolling and finishing. The three principal methods of shaping steel are rolling, casting, and forging. (Forged steel usually is made in forging shops. Occupations in those shops are described elsewhere in the *Handbook*.) About 90 percent of the steel processed in steel mills is shaped by rolling. In this method, heated steel ingots are squeezed into longer and flatter shapes between two massive cylinders or "rolls." Before ingots of steel are rolled, they are heated to the temperature specified by plant metallurgists. The heating is done in large furnaces called "soaking pits" located in the plant floor. A *soaking pit crane operator* (D.O.T. 921.883) maneuvers an overhead crane to lift the ingots from small railcars and place them in the soaking pit. A *heater* (D.O.T. 613.782) and *helper* (D.O.T. 613.885) control the soaking pit operation. They adjust controls, which regulate the flow of air and fuel to the burners, to maintain the correct temperature in each pit, and by watching dials they determine when the ingot is uniformly heated to the required temperature.


Ladle
Ingot Molds
When an ingot has solidified on the outside, a stripper crane operator may remove the mold as shown here in cutaway. The tongs lift the mold while a "plunger" holds the ingot down on the ingot car.

Liquid steel is poured from a ladle into ingot molds of various sizes. As it cools, the molten steel solidifies from the outside toward the center.

Source: American Iron and Steel Institute

When the ingots are needed in the mill, the crane operator places them on an ingot buggy, which carries them to the first rolling mill, sometimes called a "primary" mill. Here, the ingots are rolled into smaller, more easily handled semifinished products called blooms, billets, and slabs. Blooms generally are between 6 and 12 inches wide and 6 and 12 inches thick. Billets, which are rolled from blooms, have a smaller cross-section and are longer than blooms. Slabs are much wider and thinner than blooms.

Rolling ingots into blooms and slabs are similar operations; in fact some rolling mills can do both. In the mill, the ingot moves along on a roller conveyer to a machine that resembles a giant clothes wringer. A "two-high" rolling mill has two grooved rolls that revolve in opposite directions. The rolls grip the approaching red hot ingot and pull it between them, squeezing it thinner and longer. When the ingot has made one such pass, the rolls are reversed, and the ingot is fed back through them. Throughout the rolling operation, the ingot periodically is turned 90 degrees by mechanical devices called "manipulators," and passed between the rolls again so that all sides are rolled. This operation is repeated until the ingot is reduced to a slab or bloom of the desired size. It is then ready to be cut to specified lengths.

A *roller* (D.O.T. 613.782), the worker in charge of the mill, works in a glass-enclosed control booth, located above or beside the conveyor line. This employee's duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple. However, the quality of the product and the speed with which the ingot is rolled depend upon the roller's skill. The roller regulates the opening between the rolls after each pass. If the opening is set too wide, more passes will be needed to get the required shape, and production will be slowed. If the opening is too narrow, the rolls or gears may be damaged. Long experience and a knowledge of steel characteristics are required for a worker to become a roller. A *manipulator operator* (D.O.T. 613.782) sits in the booth beside the roller and operates controls that correctly position the ingot on the roller conveyor before each pass.

Upon leaving the rolling mill, the red-hot slab, billet, or bloom moves along a conveyer to a place where a *shear operator* (D.O.T. 615.782) controls a heavy hydraulic shear that cuts the steel into desired lengths.

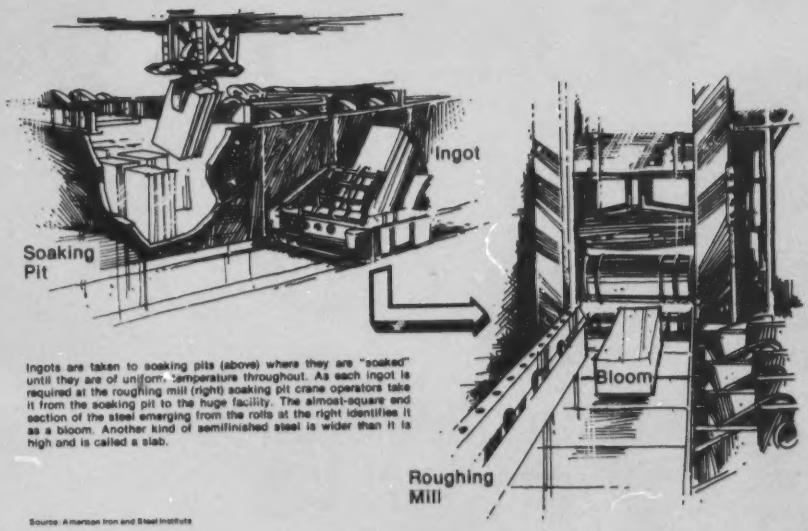
In a rolling mill that has automatic

controls, a rolling mill attendant is given a card that has been punched with a series of holes. The holes represent coded directions as to how the ingot is to be rolled. The attendant inserts the card into a card "reader" and presses a button to start the automatic rolling sequence. When this process is used, the roller's job is shifted from operating the controls to directing and coordinating the rolling process.

Of increasing use in shaping steel into slabs, blooms, and billets is the continuous casting process, which eliminates the necessity of producing large ingots that in turn must be reheated and then put through the primary mill. In one type of continuous casting, a ladle of liquid steel, a water-cooled mold of the desired product shape (for example, a bloom) and a cooling chamber are set above the plant floor. A series of rolls descend from the cooling chamber to the floor. Liquid steel is poured into the mold. The steel cools and solidifies along the bottom and lower sides of the mold. Passing down through the chamber, the steel is further cooled by a water spray. The rolls control the molded steel's descent, support its weight, and straighten it as it moves toward the plant floor. The molded steel is cut to the desired lengths as it emerges from the rolls. Continuous casting requires fewer workers than the pouring and rolling of ingots require.

After the steel is rolled or cast into primary shapes, most of it is put through finishing operations. Slabs, for example, can be reduced and shaped into sheets, and billets can be made into wire and pipe.

Steel sheet is the most important finished product made by the iron and steel industry. To make sheets, a slab is first heated in a furnace similar to the soaking pits described earlier, and then run through a hot strip mill. The hot strip mill is a continuous series of pairs of rolls, similar to the two at the primary mill. As the slab moves through each pair of rolls, it becomes thinner and longer. Edge guides control its width. After passing through the last pair of rolls, the sheet is wound into a coil. If the customer prefers a thinner sheet or an improved surface, the product may be cold rolled in another mill.



Ingots are taken to soaking pits (above) where they are "soaked" until they are of uniform temperature throughout. As each ingot is required at the roughing mill (right) soaking pit crane operators take it from the soaking pit to the huge facility. The almost-square end section of the steel emerging from the rolls at the right identifies it as a bloom. Another kind of semifinished steel is wider than it is high and is called a slab.

Source: American Iron and Steel Institute

Having obtained information on the characteristics of the sheet desired, the roller at the hot strip mill refers to a printed guide to determine the necessary gauge between each pair of rolls, and the speed at which the slab should travel. Working in a pulpit, the roller uses controls to set the gauge on the last series of rolls, while the *speed operator* (D.O.T. 613.782) works controls that adjust the speed of the rolls and conveyor. Unless problems develop, the jobs of these two workers are repetitive. However, if the sheet should begin to buckle between rolls, due to the steel's composition or temperature, these two employees must readjust the gauge and speed of the rolls in an attempt to avoid damage to the sheet.

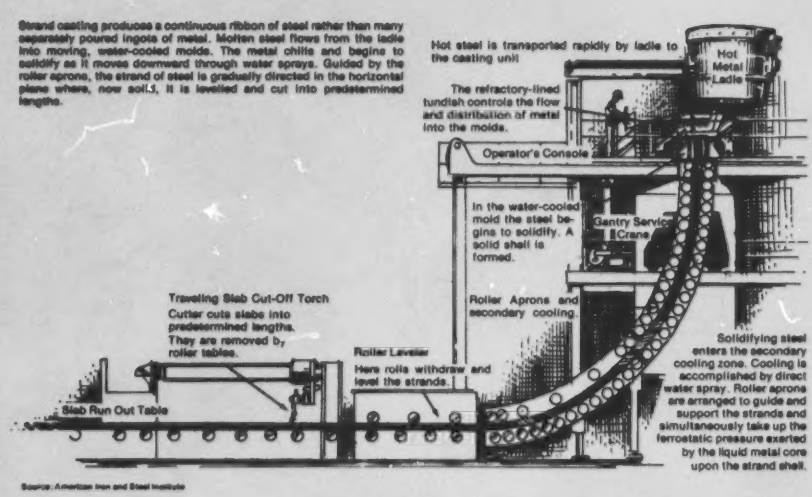
Under the direction of the roller, a *rougher* (D.O.T. 613.782) and assistant use handtools to adjust the gauge and edge guides for the first series of rolls (called the roughing mill). A *rougher pulpit operator* (D.O.T. 613.782), following the rougher's instructions, signals the furnace crew for additional slabs and operates controls to position the slab on the conveyor and guide it into the rolls.

Other important steel mill products include various types of wire and pipe. These products are made from billets. To make drawn wire, the billet is rolled into a long, thin, round product called a rod. A *wire drawer* (D.O.T. 614.782) operates equipment that pulls the steel rod through a die. The die has a tapered hole, one end of which is smaller than the rod. As the rod passes through the hole, it is made thinner and longer and becomes wire. The wire drawer positions the rod in the die, sets the speed for drawing the rod through the die, lubricates the rod and checks the wire for scratches and defects.

A *piercing-mill operator* (D.O.T. 613.885) controls machinery that makes seamless pipe. The operator moves levers that drop the hot billet from a conveyer into a trough and pass it between two barrel-shaped rolls that spin the billet and force an end of it against a sharp plug or "mandrel." The mandrel smooths the inside wall of the billet and makes the diameter of the hole uniform. The operator uses controls to remove the mandrel and drop the billet on a conveyor for further processing.

Maintenance, Transportation, and Plant Service Occupations. Large numbers of workers are required in steel plants to support processing activities. Some maintain and repair machinery and equipment, while others operate the equipment that provides power, steam, and water.

Machinists and machine tool op-


Strand casting produces a continuous ribbon of steel rather than many separately poured ingots of metal. Molten steel flows from the ladle into moving, water-cooled molds. The metal chills and begins to solidify as it moves downward through water sprays. Guided by the roller aprons, the strand of steel is gradually directed in the horizontal plane where, now solid, it is levelled and cut into predetermined lengths.
Hot steel is transported rapidly by ladle to the casting unit
Hot Metal Ladle
The refractory-lined tundish controls the flow and distribution of metal into the molds.
Operator's Console
In the water-cooled mold the steel begins to solidify. A solid shell is formed.
Gantry Service Crane
Roller Aprons and secondary cooling.
Traveling Slab Cut-Off Torch
Cutter cuts slabs into predetermined lengths. They are removed by roller tables.
Roller Leveler
Here rolls withdraw and level the strands.
Solidifying steel enters the secondary cooling zone. Cooling is accomplished by direct water spray. Roller aprons are arranged to guide and support the strands and simultaneously take up the ferrostatic pressure exerted by the liquid metal core upon the strand shell.
Slab Run Out Table
Source: American Iron and Steel Institute

erators make and repair metal parts for production equipment. Diemakers use machine tools to form dies, such as those used to make wire. *Roll turners* (D.O.T. 801.884) use lathes, grinders, and other machine tools to refinish the steel rolls used in the rolling mills.

Millwrights overhaul machinery and repair and replace defective parts. Electricians install wiring and fixtures and hook up electrically operated equipment. Electrical repairers (motor inspectors) keep wiring, motors, switches, and other electrical equipment in good operating condition.

Electronic repairers install and maintain the increasing number of electronic devices and systems used in steel manufacturing plants. Typically, this equipment includes communication systems such as closed-circuit television; electronic computing and data recording systems; and measuring, processing, and control devices such as X-ray measuring or inspection equipment.

Bricklayers repair and rebuild the brickwork in furnaces, soaking pits, ladles, and coke ovens, as well as mill buildings and offices. Pipefitters lay out, install, and repair piping that is used to carry the large amounts of liquids and gases used in steelmaking. Boilermakers test, repair, and rebuild heating units, storage tanks, stationary boilers, and condensers. Locomotive engineers and other train crew members operate trains that transport materials and products in the vast yards of iron and steel plants. Other skilled workers operate the various boilers, turbines, and switchboards in factory powerplants.

Other types of maintenance and service workers include carpenters, oilers, painters, instrument repairers, scale mechanics, welders, loaders, riggers, janitors, and guards. Many laborers are employed to load and unload materials and do a variety of cleanup jobs.

Administrative, Clerical, and Technical Occupations. Professional, administrative, clerical, and sales workers constitute about one-fifth of the industry's total employment. Of these, the majority are clerical workers, such as secretaries, stenographers, typists, accounting clerks, and general office clerks.

Engineers, scientists, and technicians make up a substantial proportion of the industry's white-collar employment. Several thousand of these workers perform research and development work to improve existing iron and steel products and processes, and to develop new ones.

Among the technical specialists employed in steelmaking are mechanical engineers, whose principal work is the design, construction, and operation of mill machinery and material handling equipment. Metallurgists and metallurgical engineers work in laboratories and production departments where they have the important task of specifying, controlling, and testing the quality of the steel during its manufacture. Civil engineers are engaged in the layout, construction, and maintenance of steel plants, and the equipment used for heat, light, and transportation. Electrical engineers design, lay out, and supervise the operation of electrical facilities that provide power for steel mill operation. Chemists analyze the chemical properties of steel and raw materials in laboratories. Laboratory technicians do routine testing and assist chemists and engineers. Drafters prepare working plans and detailed drawings required in plant construction and maintenance.

Among the employees in administrative, managerial, and supervisory occupations are office managers, labor relations and personnel managers, purchasing agents, plant managers, and industrial engineers. Working with these personnel are several thousand professional workers, including accountants, nurses, lawyers, economists, statisticians, and mathematicians. The industry also employs several thousand sales workers.

(Detailed discussions of professional, technical, mechanical, and other occupations found in the iron and steel industry as well as in many other industries are given elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

New workers in processing operations usually are hired as unskilled laborers. Openings in higher rated jobs usually are filled by promoting workers from lower grade jobs. Length of service with the company is the major factor considered when selecting workers for promotion. Promotions to first level supervisory positions, such as blower and melter, differ among companies. Some firms determine these promotions solely on seniority while others also consider ability to do the job.

Training for processing occupations is done almost entirely on the job. Workers move to operations requiring progressively greater skill as they acquire experience. A crane operator, for example, first is taught how to operate relatively simple cranes, and then advances through several steps to cranes much more difficult to run, such as the hot-metal crane.

Workers in the various operating units usually advance along fairly well-defined lines of promotion within their departments. For example, to become a blast furnace blower, a worker generally starts as a laborer, advancing to second helper, first helper, keeper, and finally blower. At a basic oxygen furnace, a worker may begin by doing general cleanup work and then advance to furnace hand, second assistant, first assistant, furnace operator, and eventually to melter. A possible line of job advancement for a roller in a finishing mill might be assistant rougher, rougher pulpit operator, rougher, speed operator, and finish roller. Workers can be trained for skilled jobs, such as blower, melter, and roller, which are among the highest rated steelmaking jobs, in a minimum of 4 or 5 years, but they may have to wait much longer before openings occur.

To help them advance in their work, many employees take part-time courses in subjects such as chemistry, physics, metallurgy and management. Steel companies sometimes provide this training—often within the plant. Other workers take evening courses in high schools, trade schools, or universities or enroll in correspondence courses.

Apprenticeship is the best way to learn a maintenance trade. Apprenticeship programs usually last 3 or 4 years and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects usually is given, either in the plant, in local vocational schools, or through correspondence schools.

Employee oversees automatically controlled charging of blast furnace.

Steelmaking companies have different qualifications for apprentice applicants. Generally, employers require applicants to have the equivalent of a high school or vocational school education. In most cases, the minimum age for applicants is 18. Some companies give aptitude and other types of tests to applicants to determine their suitability for the trades. Apprentices generally are chosen from among qualified workers already employed in the plant.

The minimum requirement for administrative, engineering, and scientific jobs usually is a bachelor's degree with an appropriate major. Practically all the larger companies have formal training programs for college-trained workers and recruit these workers directly from college campuses. In these programs, trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before they are assigned to a particular department. In other companies, the newly hired professional worker is assigned directly to a specific research, operating, maintenance, administrative, or sales unit. Engineering graduates frequently are hired for sales work and many of the executives in the industry have engineering backgrounds. Engineering graduates, as well as graduates of business administration and liberal arts colleges, are employed in sales, accounting, and labor-management relations, as well as in managerial positions.

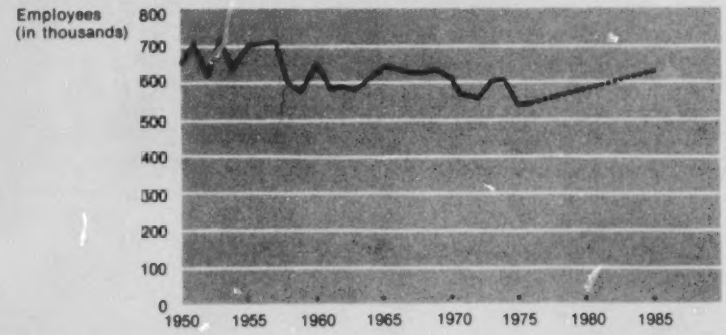
Completion of a business course in high school, junior college, or business school is preferred for entry into most of the clerical occupations. Clerical jobs requiring special knowledge of the steel industry generally are filled by promoting personnel already employed in the industry.

Employment Outlook

Employment in the iron and steel industry is not expected to change significantly through the mid-1980's. Nevertheless, many workers will be hired to replace those who retire, die, or leave their jobs for other reasons. The total number hired may fluctuate from year to year because the industry is sensitive to changes in

Technological advances have enabled the iron and steel industry to meet growing demand without long-run increases in employment

Wage and salary workers in the iron and steel industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

business conditions and defense needs.

Production of iron and steel is expected to increase as population and business growth create a demand for more automobiles, household appliances, industrial machinery, and other products that require large amounts of these metals. Because of laborsaving technology, however, employment is not expected to keep pace with increases in production. Giant blast furnaces are being built that make more iron per worker than the smaller furnaces they are replacing. Some blast furnaces now have conveyor systems that automatically weigh and transfer raw materials from the storage areas to the furnace. Such systems will eliminate stockhouse jobs such as the scale car operator. Open hearth furnaces will continue to be replaced with more efficient basic oxygen furnaces, increasing the amount of steel produced per worker. Older primary rolling mills will be replaced by continuous casters, which use fewer employees to produce slabs, billets, and blooms. Greater use of computers to control plant equipment, as in hot finishing mills, and to process business records also will increase productivity.

Employment trends will differ among occupations. The number of job opportunities for engineers, metallurgists, laboratory technicians, and other technical workers will increase as the industry's research and development programs expand. Employment of computer systems analysts and programmers also will increase because computers will perform more of the work in the steelmaking operations. Some maintenance workers such as electronic repairers will be needed in greater numbers to maintain the increasingly complex machinery used by the steel mills. Employment of other maintenance workers—for example, bricklayers and carpenters, who work extensively on open hearth furnaces—will decline because they work on equipment that is being replaced. Employment in processing occupations is expected to decline slightly as more efficient plant machinery and equipment are introduced.

Earnings and Working Conditions

Earnings of production workers in iron and steelmaking are among the highest in manufacturing. In 1976, they averaged $7.68 an hour, while production workers as a whole averaged $4.87. To show how earnings vary by occupation and department, wage rates for employees in some of the principal occupations are presented in table 1. However, most steelworkers are paid on an incentive basis—that is, the more they produce the more they earn—and often earn more than the table would indicate.

Most production workers in the iron and steel industry are members of the United Steelworkers of America. Agreements between steel companies and the union include some of the most liberal fringe benefits in industry. Most workers receive vacation pay ranging from 1 to 5 weeks, depending on length of service. A worker in the top 50 percent of a seniority list receives a 13-week va-

Approximate basic straight-time hourly earnings [1] of workers in selected occupations in basic iron and steel establishments, mid-1976

	Hourly earnings
Blast furnaces:	
Larry or scale car operators	$6.55
Keepers	6.95
Basic oxygen furnaces:	
Second assistants (Second helper)	6.95
Furnace operators	7.80
Open hearth furnaces:	
Charging machine operators	7.20
Furnace operators (First helper)	8.15
Bloom, slab and billet mills:	
Soaking pit crane operators	7.05
Rollers	8.35
Continuous hot-strip mills:	
Roughers	7.20
Rollers	8.90
Maintenance:	
Bricklayers	7.30
Millwrights	7.20

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts and incentive pay.

cation every 5 years; the remaining workers receive 3 extra weeks of vacation once in a 5-year period. Professional and executive personnel receive similar benefits.

Workers may retire on company-paid pensions after 30 years of service, regardless of age. Employees having 2 years or more of service are eligible to receive supplemental unemployment benefits for up to 52 weeks. Other benefits include health and life insurance, and education and scholarship assistance.

Working conditions vary by department. Work in almost all professional and clerical jobs and many maintenance jobs is done in comfortable surroundings. Workers near the blast and steel furnaces and in the rolling mills, however, are subject to extreme heat and noise. For example, when raw materials such as scrap steel are loaded into a steel furnace a thunderous roar occurs. The temperature in the building which surrounds the blast furnace remains extremely high even in the middle of winter. Many plants have developed methods to reduce job discomfort. The use of remote control, for example, enables some employees, such as furnace operators, to work outside the immediate vicinity of processing operations. In other instances, the cabs in which the workers sit while operating mechanical equipment, such as cranes, may be air-conditioned. Because certain processes are continuous, many employees are on night shifts or work on weekends.

Sources of Additional Information

For additional information about careers in the iron and steel industry, contact:

American Iron and Steel Institute, 1000 16th St. NW., Washington, D.C. 20036.

United Steelworkers of America, Five Gateway Center, Pittsburgh, Pa. 15222.

OCCUPATIONS IN LOGGING AND LUMBER MILLS

The logging and lumber mill industry offers a variety of careers for people who enjoy outdoor work. Logging camps and sawmills provide many job opportunities, especially in the South and Pacific Northwest, the Nation's major timber-producing regions.

Nature and Location of the Industry

In 1976, about 75,000 wage and salary workers were employed in logging—harvesting trees and removing them from forests. A much larger number—about 210,000—worked in sawmills and planing mills where logs are converted into lumber. In addition, there were about 60,000 self-employed workers, most of them in logging.

This statement deals with activities and jobs involved in cutting and removing timber from forests and in the processing of logs into rough and finished lumber. It excludes the manufacture of paper, plywood, veneer, and other wood products such as furniture and boxes. Occupations in paper manufacturing are discussed in a separate statement elsewhere in the *Handbook*.

Lumber production has followed the same basic process for many years. A stand of timber is harvested in the forest, moved to a central location or "landing" accessible to transportation, and then carried by truck or rail to a mill for processing. Logging crews typically consist of from 5 to 15 workers. Several crews, each working at a different location, may be needed to supply logs for a single mill. The crew moves through the forest as one area after another is harvested. Years ago these workers lived in camps close to the cutting site. With better roads and transportation, almost all can now live at home and commute to work.

In the sawmill, logs are debarked, rough-sawn into boards or timbers of various widths and lengths, and then seasoned (dried) so the wood will not warp. A small amount of rough lumber is sold without further processing, but the rest must be sent to a planing mill before it goes to market. In the planing mill, rough boards are finished to give them a smooth surface. Boards also are made into flooring, siding, moulding, and other forms of building trim. Since logs cost more to ship than processed lumber, sawmills usually are located near tree-harvesting areas. Some of these mills are small, portable operations that can be moved about from week to week as the harvest progresses, but the large ones are permanent. Planing mills may be part of sawmill operations or may be separate facilities miles away. Many sawmills and planing mills employ fewer than 20 workers, but some have more than 100.

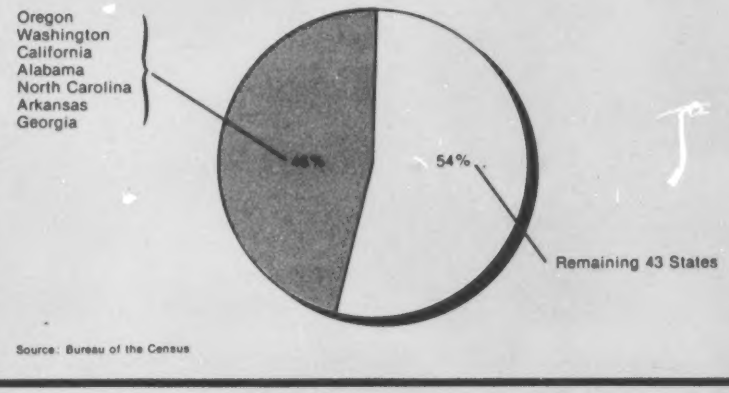
Although some logging and lumber mill workers are employed in nearly every State, seven States account for about half of the industry's employment: Oregon, Washington, California, Alabama, North Carolina, Arkansas, and Georgia.

Logging. Before a stand of timber is harvested, a *forester* (D.O.T. 040.081) selects and marks which trees to cut. Foresters also map the cutting areas, plan and supervise the cutting, and plant seedlings to replace the trees that were removed. *Forestry technicians* (D.O.T. 441.384) assist foresters in performing these duties. *Timber cruisers* (D.O.T. 449.287) estimate the amount and grade of standing timber and help foresters make maps. Heavy equipment operators build access roads and trails to the cutting and loading areas so that they can be reached by logging crews.

The initial harvesting task—"falling and bucking"—is the process of cutting the tree down and further cutting (bucking) it into logs for maximum product value and easier handling. *Fallers* (D.O.T. 940.884), working singly or in pairs, use powersaws to cut down large trees marked by the forester. Expert fallers can usually drop a tree in the exact spot

Nearly half of all logging and lumber mill workers are employed in seven States

State distribution of employment in logging and lumber mills, 1970



Source: Bureau of the Census

where they want it, without injuring other trees. As soon as the tree is down, *buckers* (D.O.T. 940.884) saw the limbs off and saw the trunk into logs. Sometimes, small trees are felled with tree harvesters, which are machines mounted on a tractor and operated by a *logging-tractor operator* (D.O.T. 929.883).

The next task—"skidding"—is a method of removing logs from the cutting area. A choker (steel cable) is noosed around the log by *choker setters* (D.O.T. 942.887) and then attached to a tractor, which drags or "skids" the log to the landing. A *rigging slinger* (D.O.T. 942.884) supervises and assists choker setters and tractor drivers.

Sometimes, other methods of removal are necessary or desired. In rough terrain in the West, where logs must be moved up or down steep slopes or across ravines, the "high-lead" method is used instead of skidding. This method is somewhat like a fishing rod and reel. Steel cables run from a diesel-powered winch (reel) through pulleys at the top of a large steel tower (rod) and down to the cutting area which may be hundreds of feet away from the tower. Choker setters noose the end of the cable around a log and a *yarder engineer* (D.O.T. 942.782) operates the winch to pull the log into the landing. Other methods include the use of heavy-duty helicopters and balloons that lift logs weighing several tons and carry them to the loading sites. The major advantages of these methods are that forest obstacles may be avoided more easily and environmental damage caused by dragging logs across the land is reduced.

After logs reach the landing, they are loaded on a truck trailer and hauled to a mill. A *loader engineer* (D.O.T. 921.883) operates a machine that picks up logs and places them on the trailer. A *second loader* (D.O.T. 949.884) directs the positioning of logs on the trailer. Although trucks usually are used, logs are sometimes carried by railroad cars.

Sawmills and Planing Mills. At the sawmill incoming logs are stacked on the ground (cold decking) or dumped into a pond to await cutting.

Loader operators take logs from landing area and place them on trucks to go to plants for processing.

Water storage protects the logs from splitting, insect damage, and fire. Cold decking, on the other hand, permits greater storage volume per acre, and some trees such as oak must be stored this way because they will sink in water. *Log scalers* (D.O.T. 941.488) measure logs and look for defects, such as knots and splits, to estimate the amount and quality of lumber available. *Pond workers* (D.O.T. 921.886) sort the logs so that all of one kind or size go into the mill together.

A *bull-chain operator* (D.O.T. 921.885) controls a conveyor that pulls logs up a chute into the sawmill. A *barker operator* (D.O.T 533.782) operates machinery to remove bark and foreign matter that could damage saws. One kind of machine has rough metal bars or knives that rub or chip the bark away. Another kind tears it off with the high pressure force of water. The removed bark may be processed into garden mulch or burned to produce heat and steam for the sawmill.

As a log enters the sawing area, a *deck worker* (D.O.T. 667.887) rolls it onto a platform called a "carriage," and a *block setter* (D.O.T. 667.885) aligns the log and locks it into position. The carriage, which moves back and forth on rails, carries the log into the teeth of a large bandsaw; each time the log passes the saw a board is sliced off. This operation is controlled by a *head sawyer* (D.O.T. 667.782), who is one of the most experienced workers in the mill. The quality and quantity of usable lumber obtained from logs depends largely on the head sawyer's skill and knowledge.

After leaving the carriage, the lumber moves to an edger saw, consisting of two or more circular blades. Operated by a *pony edger* (D.O.T. 667.782), the edging machinery cuts the lumber to the desired width. For example, the production run may be cutting boards to a 4-inch width. Next, a *trimmer saw operator* (D.O.T. 667.782), using a series of circular cross-cut saws, cuts the lumber to various lengths, such as 8, 10, or 12 feet.

When all sawing is completed, a conveyor system moves the rough lumber into a sorting shed, where *graders* (D.O.T. 669.587) examine each board and determine its grade according to set standards of quality and value. After grading, *sorters* (D.O.T. 922.887) pull and stack the lumber according to type, grade, and size.

At this stage, the lumber is still green and must be seasoned so that it will not shrink or warp. It may be stacked outdoors where the sun and wind will remove excess moisture. More frequently, however, it is placed in a specially heated building (dry-kiln). *Dry-kiln operators* (D.O.T. 563.381) control temperature, humidity, and ventilation in kilns.

Some seasoned lumber is ready for use without further processing. Most of the lumber, however, must pass through a planing mill before being shipped to market. In this mill, the rough dried lumber is run through a

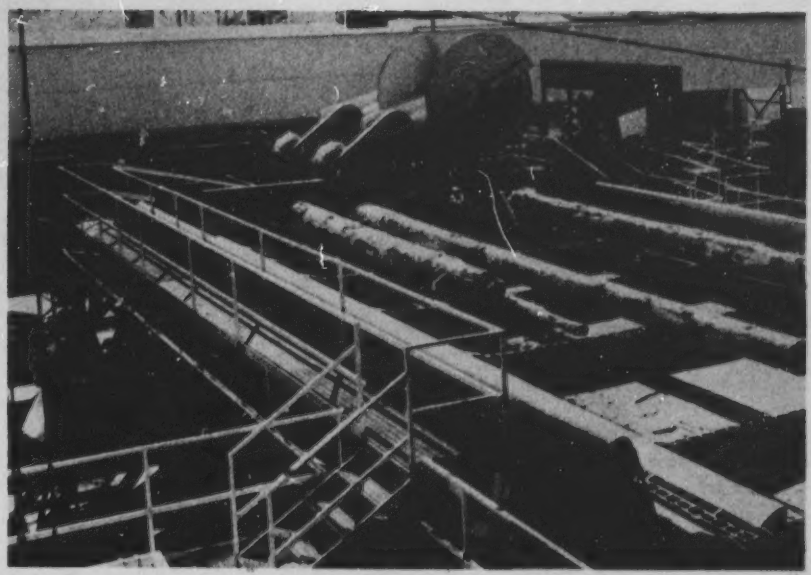
set of rotating knives controlled by a *planer operator* (D.O.T. 665.782). Some knife heads produce smooth surfaces, while others tongue-and-groove the boards for flooring or paneling. Similarly, a wide variety of moulding or other building trim may be cut. The dressed or finished lumber is usually graded again before storage by a *planer mill grader* (D.O.T. 669.587). The milling process is now ended and the lumber is ready for shipment.

In addition to those already described, workers in many other occupations requiring a broad range of training and skill are needed in the logging and milling processes. Maintenance mechanics install and repair saws and related machinery. Saw filers sharpen and repair saws, and electricians maintain and repair wiring, motors, and other electrical equipment. Increasingly, people with electronics backgrounds are being hired to maintain the growing amount of electronically controlled or operated equipment. Truckdrivers transport logs to the mills and deliver the finished lumber products to wholesalers.

Many workers are employed in clerical, sales, and administrative occupations. For example, many companies employ office managers, purchasing agents, personnel managers, salesworkers, office clerks, stenographers and typists, bookkeepers, and business machine operators. Also, the industry employs professional and technical workers, such as civil and industrial engineers, drafters and surveyors, and accountants. (Detailed discussions of professional, technical, and mechanical occupations, found not only in logging and milling but in other industries as well, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Training, Other Qualifications, and Advancement

Most loggers and millhands get their first jobs without previous training. Employers prefer high school graduates, but applicants with less education frequently are hired. Entry level jobs usually can be learned in a few weeks by observing and helping experienced workers.



Saw operator cuts logs into 8-foot lengths for plywood.

A beginning logger may start by helping choker setters or buckers. After gaining logging experience and basic skills, workers may advance to higher paying positions as vacancies occur. Those with an aptitude for operating machinery may become a yarder engineer, or a tractor operator. Others may be interested in the highly skilled faller or bucker jobs.

In the mill, the beginner often is assigned to a labor pool to do odd jobs, such as sorting and stacking lumber. Millhands may be trained to operate various machines such as the edger saw or a band saw. Other mill workers may be able to pursue careers in lumber sales and marketing, or be trained for research jobs.

Mechanics, electricians, and others who repair and maintain the industry's equipment are trained on the job under the guidance of supervisors and experienced workers. In some companies, this training is supplemented by classroom instruction. Maintenance trainees frequently are selected from workers already employed in mills or logging crews. Many firms, however, will hire inexperienced people who have mechanical aptitude. Generally, it takes a trainee 3 to 4 years to become skilled in one of the maintenance jobs.

Workers who have leadership ability and years of experience can advance to supervisory positions in mills and logging crews. Many of the smaller logging companies and sawmills are owned by people who began their careers as loggers or millhands.

Loggers and millhands must be in good physical condition. Although modern equipment has reduced some of the heavy labor, stamina and agility are still important qualifications, particularly for loggers. Because of the danger involved in operating and working around heavy machinery, workers should be alert and well coordinated.

A bachelor's degree usually is the minimum educational requirement for forester, engineer, accountant, and other professional occupations. Completion of commercial courses in high school or business school usually is adequate for entry into clerical occupations, such as secretary, typist, and bookkeeper.

Employment Outlook

Employment in logging and lumber mills is expected to decline through the mid-1980's despite anticipated increases in lumber production to meet the Nation's population and industrial growth. Laborsaving machinery will make it possible to harvest more timber and process more lumber with fewer employees.

Nevertheless, many workers will be needed each year to replace those who retire, die, or leave the industry for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for lumber is sensitive to changes in construction activity.

Employment in logging camps and mills will decline over the long run as more modern equipment and techniques are adopted. A tree harvester, for example, which has a scissor-like pair of blades, can cut down a tree four times as fast as a saw. As more harvesters come into use, fewer logging workers will be required. Sawmills and planing mills may reduce employment requirements by installing new machinery and improving plant layouts. In the kiln area, for example, a stacking machine operated by two or three people can replace six who stack by hand.

Although employment in the industry as a whole is declining, certain occupations will grow. Additional mechanics, for example, will be needed to maintain the growing stock of logging equipment, trucks, and mill machinery. More foresters and forestry technicians will find jobs in this industry as forest replanting and conservation programs receive greater attention. Engineers will be in greater demand as the industry's production methods become more complex. As in the past, however, most of the industry's job openings will be for logging and mill workers; because they make up a very large proportion of the industry's total employment, replacement needs are high.

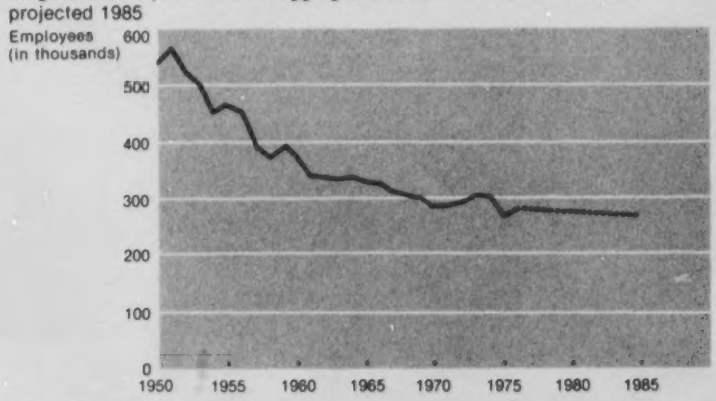
Summer jobs sometimes are available for high school students 17 years of age or older. These jobs are unskilled and include such tasks as working on a survey crew, helping haul logs to landings, clearing brush, and fighting forest fires.

Earnings and Working Conditions

In 1976, production workers in sawmills and planing mills averaged $4.59 an hour. In comparison, production workers in manufacturing industries as a whole averaged $5.17 an hour.

Laborsaving machinery has cut employment in the logging and lumber mills industry in half since 1950

Wage and salary workers in logging and lumber mills, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Wage rates in logging, sawmills, and planing mills vary considerably by occupation and geographic area. Workers in different regions of the United States often earn vastly different hourly wages for doing the same job. Average hourly rates for selected occupations in Western logging camps and sawmills in 1976 are shown in the accompanying tabulation. Workers in the South earned considerably less than those in the West.

Logging and lumber mill workers often must do their jobs under unpleasant working conditions. Most logging jobs are outdoors and the weather often is very yot and humid or extremely cold. The forest may be wet and muddy, with many annoying insects during the summer. Sometimes, working time and pay may be lost because of heavy rain or snow or very extreme temperatures. Although usually sheltered, sawmills and planing mills may be noisy and dusty, and uncomfortably warm during the summer. Moreover, work at logging sites and in mills is more hazardous than in most manufacturing plants. For many persons, however, the opportunity to work and live in forest regions away from crowded cities more than offsets these disadvantages.

The major unions in this industry are the International Woodworkers of America (AFL-CIO) and the Lumber Production and Industrial Workers, an affiliate of the United Brotherhood of Carpenters and Joiners of America (AFL-CIO). On the

Logging	*Hourly rates, West Coast*
Deck workers	$6.00
Pond workers	6.00
Sorters	6.25
Trimmers	6.25
Choker setters	6.45
Pony edgers	6.45
Truckdrivers	6.55
Graders	6.65
Lumber stackers	6.80
Planer operators	7.00
Rigging slingers	7.10
Yarder engineers	7.70
Head-saw operators, circular saw	7.80
Head-saw operators, band saw	8.30
Fallers and buckers	9.15

West Coast, a large proportion of the industry's production workers are covered by union-management contracts. In the South, on the other hand, relatively few are covered.

Sources of Additional Information

For further information about job opportunities and working conditions, contact:

International Woodworkers of America, 1622 N. Lombard St., Portland, Oreg. 97217.

Wood Industry Careers, National Forest Products Association, 1619 Mass. Ave. NW., Washington, D.C. 20036.

MOTOR VEHICLE AND EQUIPMENT MANUFACTURING OCCUPATIONS

At the beginning of this century, motor vehicle manufacturing was a virtually unknown industry. Today, by a number of measures, the industry is one of the most important in the Nation.

A measure of an industry's role in the economy is the importance of the products it makes. The products of motor vehicle manufacturing cars, trucks, and buses are a vital part of our transportation system. Heavy trucks are used in industries such as mining to haul raw materials and heavy equipment, and by other industries such as trucking to carry a wide variety of goods from one part of the country to another. Small trucks carry bread, mail, building materials, and hundreds of other items for short distances. Buses are used for both local and transcontinental transportation, as well as for shipping some goods. Automobiles provide people with the ability to go anywhere in the country whenever they desire.

Another measure of an industry's economic importance is the number of people it employs. Motor vehicle manufacturing employs more workers than any other single manufacturing industry, almost 1 out of every 100 workers in the Nation's labor force works in motor vehicle manufacturing.

Still another indicator is the number of jobs an industry creates in other sectors of the economy. Motor vehicle manufacturing is important for two reasons. First, it is a major consumer of steel, rubber, plateglass and other basic materials needed to produce motor vehicles. As a result, numerous employment opportunities are created in the industries that produce these materials. Second, a number of industries employing large numbers of workers have been created because of motor vehicles. Some of these industries are motor vehicle repair shops, automobile dealerships, gas stations, highway construction, and truck and bus transportation facilities.

As in other large industries, the workers in motor vehicle manufacturing have widely different levels and types of education and training. Job requirements vary from a college degree for engineers and other professional and technical workers to a few hours of on-the-job training for some assemblers, materials handlers, and custodians.

Nature and Location of the Industry

The automobile industry is able to produce millions of vehicles because of mass production of standardized parts and assembly line manufacturing. Parts plants make thousands of interchangeable parts that are put together by workers at assembly plants to build complete vehicles. New cars are driven off the assembly line at the rate of about one a minute.

The industry has about 3,000 plants, ranging from small parts plants with only a few workers to huge assembly plants that employ several thousand. About 85 percent of the industry's employees work in plants with 500 workers or more.

Over two-thirds of the industry's employees work in the Great Lakes region, including Michigan, Ohio, Indiana, Illinois, Wisconsin, and western New York. Michigan alone has almost 40 percent of the total, with half of these workers in the Detroit metropolitan area. Other important industry centers in the Great Lakes area are Flint and Lansing, Michigan; Cleveland and Warren, Ohio; Indianapolis and Fort Wayne, Indiana; Buffalo, New York; and Chicago, Illinois.

Major automobile manufacturing centers are also found in other parts of the country, including Los Angeles, San Francisco, Kansas City, St. Louis, Atlanta, and Philadelphia.

How Automobiles are Made

There are three stages in making an automobile: Designing, engineering, and testing; production of parts and subassemblies; and final assembly. Although the rest of this statement discusses only automobiles, the information also applies to trucks, buses, and other motor vehicles.

Designing, Engineering, and Testing. About 2 to 3 years of designing, engineering, and testing precede the actual production of a new car.

First, executives decide what type of car to produce—a sports car, compact, or luxury car—based on what their market research shows about consumers' desires. Once this decision has been made, they determine basic specifications for the car's size and cost. Design of the car's body and interior is assigned to stylists. From the sketches and drawings, skilled model makers make scale and full-size clay and fiberglass models of the car that are used to refine the styling, to evaluate safety features, and finally to make master dies for producing the car. Engineers, usually working with drafters who draw up blueprints and specifications, design the car's engine, transmission, suspension, and other parts. Their designs must meet safety and pollution control standards, as well as pass cost, fuel economy, and performance tests. They work with physicists, chemists, metallurgists, and other scientists to develop new parts, stronger and lighter metal alloys, new ways to use plastic and fiberglass, and thousands of other improvements in automobile design.

Each new design and improvement is thoroughly tested in the laboratory and on special test tracks that can duplicate almost every driving condition. Engines are run thousands of miles to test their durability. Safety features are tested in the laboratory and in actual crashes. Components that fail must be redesigned before the car can be produced.

On-the-road testing of fuel economy and tailpipe emissions.

Production of Parts. Once the car's final design has been agreed upon and the decision to go ahead with production has been made, the thousands of parts that are needed to mass produce complete vehicles must be manufactured. Parts are made using a number of different methods and a variety of materials, including steel, copper, aluminum, glass, rubber, plastic, and fabric.

Even metal parts are made by a number of different methods. The metalworking process used to make each part is determined by a number of factors, including the size of the part to be made, the amount of stress to which the part will be subjected, and the degree of precision required. Bulky parts, such as engine blocks, are made using the casting process. Another process, called forging, is used for axles, crankshafts, and other parts that must withstand great amounts of stress. Body panels are made by a process called metal stamping in which huge presses stamp sheet metal into the shape of the desired part. Other parts such as alternators and carburetor parts are machined to exact dimensions. These metalworking processes are explained more fully under plant occupations.

A variety of manufacturing processess are used for the windows, trim, and interior. Plastic and glass parts are molded and cut, seat cushions are sewn, and many parts are painted.

Throughout production many inspections and tests are made to insure that the assembled car will meet quality and safety standards.

Final Assembly. After many months of designing, testing, and producing parts, the car is finally ready for assembly. Each worker on the assembly line has a specific task to perform as the conveyor carries the chassis along the assembly line. Axles are attached; the engine and transmission are mounted; body panels are welded together, painted, and joined to the chassis; and instrument panels and seats are installed. Near the end of the line, hubcaps, mirrors, and other finishing touches are added. Gasoline is pumped into the fuel tank, headlights and wheels are aligned, and the car is inspected and driven off the line. The whole final assembly process may take as little as 90 minutes.

Assembling hundreds of cars a day requires expert timing and coordination. Parts and subassemblies are delivered according to production schedules arranged months in advance in order that they may be fed without interruption to workers from storage areas along the assembly line. Workers at each assembly station receive instructions for the color and special equipment for each car that passes along the line. This allows cars of different colors and types to follow each other on the assembly line. A blue sedan, for example, may follow a red station wagon. Throughout the assembly process, inspections are made to assure that each car is being put together correctly.

Occupations in the Industry

The automobile industry employs workers in hundreds of occupations. Semiskilled plant workers, including assemblers and inspectors, make up about one-half of all employees. An additional one-quarter are supervisors, machinists, tool-and-die makers, mechanics,and other skilled craft workers. Clerical workers make up another one-tenth of the total. The rest are professionals, technicians, sales workers, managers, guards, and unskilled workers.

Some of the important occupations are described briefly below. Detailed discussions of many of the professional, technical, craft, and plant jobs may be found elsewhere in the *Handbook*.

Professional and Technical Occupations. The modern automobile is the product of the research, design, and development work of thousands of engineers, chemists, drafters, and other professional and technical workers.

Over 30,000 engineers worked in the automobile industry in 1976. Most of them were mechanical, electrical, or industrial engineers. Mechanical engineers design improvements for engines, transmissions, and other working parts. Electrical engineers design the car's electrical system, especially the ignition system and accessories. Industrial engineers concentrate on plant layout, work standards, scheduling, and other production problems. The industry also employs metallurgical, civil, chemical, and ceramic engineers.

The industry employed over 3,000 mathematicians, physicists, chemists, and other physical scientists in 1976. Most of them work on research and development projects, such as finding ways to reduce fuel consumption and air pollution and studying the behavior of metals under certain conditions. Mathematicians and statisticians design quality control systems and work with research scientists and engineers. Some scientists supervise technical phases of produc-

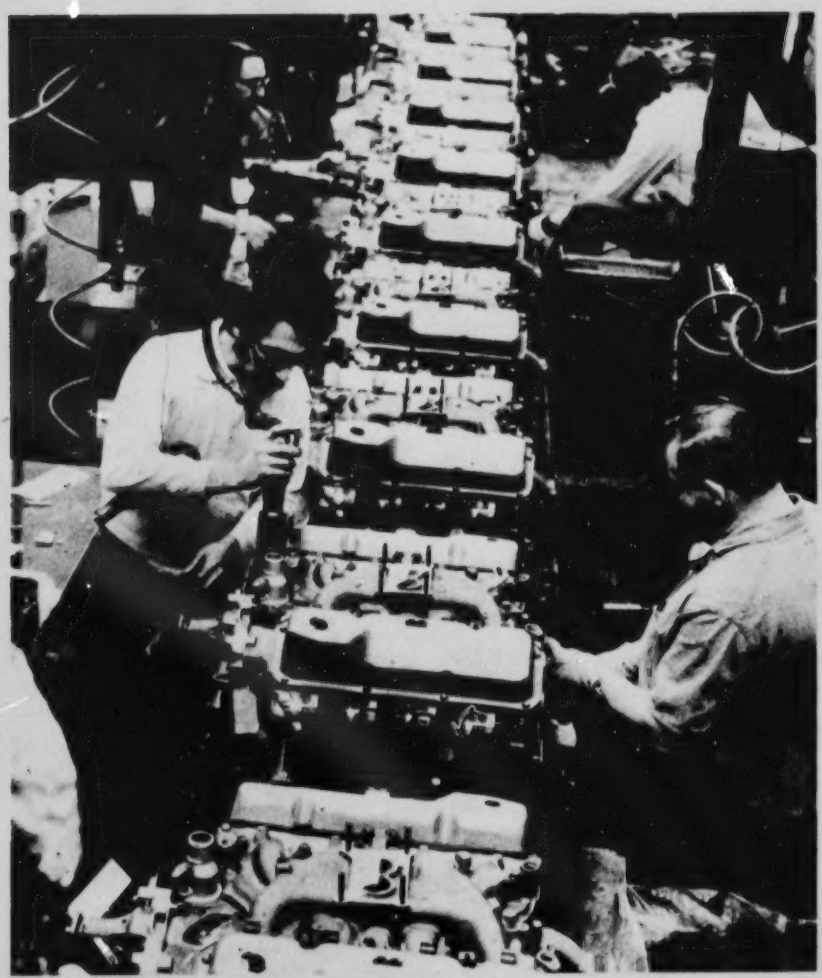
tion. Metallurgists, for example, supervise melting and heating operations in the casting and forging departments.

Drafters are the largest group of technical workers. They work closely with engineers and stylists to draft blueprints and specifications for each part of the car. Engineering aides, laboratory assistants, and thousands of other technicians also assist engineers and scientists.

Administrative, Clerical, and Related Occupations. Executives decide what kind of vehicles to produce, what prices to charge, where to build plants, and whether to manufacture or buy certain parts. They are assisted by lawyers, market analysts, economists, statisticians, industrial relations experts, and other professionals, who may also supervise plant or office staffs. Purchasing agents, personnel managers, and other administrative workers direct special phases of the company's business.

Secretaries, bookkeepers, shipping clerks, keypunch and business machine operators, typists, and other clerical employees work in the industry's plants and offices.

Plant Occupations. About three-fourths of the automobile industry's employees work in the plant. Most of these workers are engaged directly in the production process making parts or working on the assembly line. Other plantworkers such as maintenance machinists and stationary engineers help support the production process by servicing and repairing machinery and equipment.



The largest group of workers in the automobile industry are assemblers.

Foundry Occupations. Engine blocks and many other parts are "cast" or molded from melted metal. Patternmakers, coremakers, and machine molders make sand molds that have a hollow space inside in the shape of the part they are making. Workers called melters and pourers melt the metal in electric furnaces, or cupolas, and pour it into the mold. After the metal cools and hardens into the shape of the part, shakeout workers remove the casting from the mold.

Forging Occupations. Forging produces metal that is exceptionally strong; thus the forging process is used to make parts such as crankshafts and axles that must withstand heavy wear. Before metal can be shaped using this process, it must be heated in very hot furnaces called forges. After the metal is glowing hot, it is placed between two metal dies, which together form the shape of the desired part. Then, with tremendous force, these dies are brought together by hammers or presses that squeeze the metal into the desired shape. After the metal has been shaped, other workers remove rough edges and excess metal and perform other finishing operations such as heat treating and polishing.

Machining and other Metalworking Occupations. Most rough cast, forged, and some stamped parts must be machined to exact dimensions before they can be used. Engine cylinders, for example, must be bored out to precise dimensions that could not be achieved using the casting process alone. Machine tool operators, representing one of the industry's largest metalworking occupations, run machine tools that cut or grind away excess metal from rough parts. Most operators use only one kind of machine tool and have job titles related to the type of machine tool they operate, such as lathe operator or milling machine operator.

Some machine tools are automatic and can be linked together to do a series of machining operations. A rough engine block, for example, can

be moved through hundreds of automatic drilling, cutting, and grinding operations with little or no manual labor. Some of the inspection also is automatic. Operators of those machines are required only to monitor a control panel to spot interruptions and breakdowns. Other types of machine tools need more highly skilled operators who can change or adjust cutting edges, determine proper feed speeds for the metal to be machined, and check the accuracy of machined parts.

Assembly Occupations. The largest group of workers in the automobile industry are the *assemblers* (D.O.T. 806.887). They put together small parts to make subassemblies, and put subassemblies together to build a complete vehicle. Each assembler has a specific job to do as the vehicle passes a work station. For example, one worker mounts a tire and the next worker tightens the nuts with a power wrench. Most assembly jobs are repetitive and require limited skills. However, they do require good coordination, and may be strenuous.

Finishing Occupations. "Finishing" includes painting, polishing, upholstering, and other operations that protect the car's surface and add to the car's comfort and appearance. *Electroplaters* (D.O.T. 500.885) coat bumpers, grills, hubcaps, and trim with chrome. *Metal finishers* (D.O.T. 705.884) file and polish rough metal surfaces in preparation for painting. *Sprayers* (D.O.T. 741.887) apply primers and paint with power spray guns. *Polishers* (D.O.T. 705.884) polish finished surfaces by hand or with a power buffing wheel.

Several different kinds of workers are involved in making the car's upholstery. Working from a pattern, *cutters* (D.O.T. 781.884) cut fabric or leather with hand or electric shears. *Sewing machine operators* (D.O.T. 787.782) sew the pieces together into seat covers or headliners. *Cushion builders* (D.O.T. 780.884) fasten springs, padding, and foam rubber to the seats and other upholstered areas and install the covers.

Inspection Occupations. (D.O.T. 806.281, .283, .381, .382, .387, .684, and .687). Throughout the manufacture and assembly of a new car, inspectors check certain parts for defects. They inspect raw materials, examine parts during manufacturing, check the quality and uniformity of subassemblies, and test-drive the new car. Inspectors need various skills, depending on the part of the process they inspect. Some inspectors must be able to read blueprints and specifications to determine the required dimensions for the parts they check. They then use micrometers and other precision measuring instruments to insure that the parts meet specifications. Other inspectors use testing instruments such as dynamometers to be sure that engines are working properly.

Other Plant Occupations. Many other workers help keep the plant operating smoothly by delivering materials and parts, repairing equipment, and cleaning and guarding the plant.

Keeping the assembly line running smoothly requires an elaborate materials handling and delivery system. First, materials handlers load and unload raw materials and parts from trucks, ships, and railroad cars. Large and heavy materials—for example, heavy machinery or raw steel—are then moved about the plant by overhead crane operators, while other parts and materials are moved by power truck operators. Checkers, stock chasers, and stock clerks receive and distribute materials and keep records of shipments to make sure parts and tools are delivered to the assembly line at the right time.

A large staff of workers set up the plant's equipment and keep it in good condition. Skilled maintenance mechanics and electricians service and repair complex mechanical hydraulic, electrical, and electronic equipment. Millwrights move and install heavy machinery. Plumbers and pipefitters lay out, install, and repair piping, valves, pumps, and compressors. Carpenters, stationary engineers, and sheet-metal workers also work in automobile plants.

The industry also employs many protective service workers to keep plants secure and many custodial workers to keep them clean. Most of the protective service workers are guards, while janitors and porters make up a large portion of the custodial work force in the industry.

Training, Other Qualifications, and Advancement

Engineers and scientists must have at least a bachelor's degree with an appropriate major. Advanced degrees or specialized experience sometimes are required for research and development jobs. About a dozen colleges offer undergraduate or graduate courses in automotive engineering, and many companies have training programs in automotive specialties for engineers and scientists. Most companies also offer grants, loans, or tuition refund plans to their employees for advanced study. Engineers and scientists may become supervisors of research or production units, and sometimes enter administrative or executive positions.

Most automotive stylists are graduates of art institutes or have bachelor's degrees in industrial design. They should have a background in practical applications, such as model building, as well as in design theory and techniques.

Most engineering aides, laboratory assistants, drafters, and other technicians in the automobile industry are graduates of technical institutes or junior colleges. Others are trained on the job, at company schools, or at company expense at local technical schools or junior colleges. Technicians sometimes advance to engineering jobs through experience and study toward an engineering degree.

Although a college education is not always required, administrative jobs usually are filled by people with degrees in business administration, engineering, marketing, accounting, industrial relations, and similar fields. Some companies offer advanced training in these specialties.

For semiskilled jobs, the industry seeks people who can do routine work at a steady pace. Most assembly jobs can be learned in a few hours, and the less skilled machine operating jobs can be learned in a few weeks. Plant workers should be in good health and have good coordina-

tion and ability to do mechanical work.

Tool-and-die makers, patternmakers, electricians, and some other craft workers in the automobile industry need at least 4 years of training. Although many persons learn their skills by working with experienced craft workers, apprenticeship training is the best way to learn a skilled trade. Automobile manufacturers, working with labor unions, offer apprenticeships in many crafts.

Applicants for apprenticeship usually must be high school, trade, or vocational school graduates, or have equivalent training. Training should include mathematics, science, mechanical drawing, and shop courses. Apprentices must pass physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprenticeship includes both classroom and on-the-job instruction. Shop math, blueprint reading, shop theory, and special subjects such as electronics and hydraulics are studied in the classroom. In the shop, apprentices learn the techniques of their trade and how to use tools and machinery.

Supervisors usually are selected from workers already employed in the firm, especially if they have completed an apprenticeship and have considerable experience. Manufacturers usually have special training programs for newly promoted supervisors that provide instruction in the various aspects of their new job.

Employment Outlook

Employment in the automobile industry is not expected to increase significantly through 1985. Nevertheless, thousands of workers will be hired in this large industry each year to replace those who retire, die, or transfer to other industries. The total number hired will fluctuate from year to year because the industry is sensitive to changes in general business conditions, consumer preferences, availability of credit, and defense activity.

The production of motor vehicles is expected to increase during the next decade as population and income increase. Because of laborsaving technology, however, employment in the industry will not keep pace with production. Automobile companies will use more automated and computerized equipment for machining, assembling, and inspecting. A recent example is the versatile "industrial robot" that can be programmed to weld body panels, feed parts into machine tools, and do a variety of other tasks. Also, new or modernized plants will have the latest conveyor equipment for moving parts and materials.

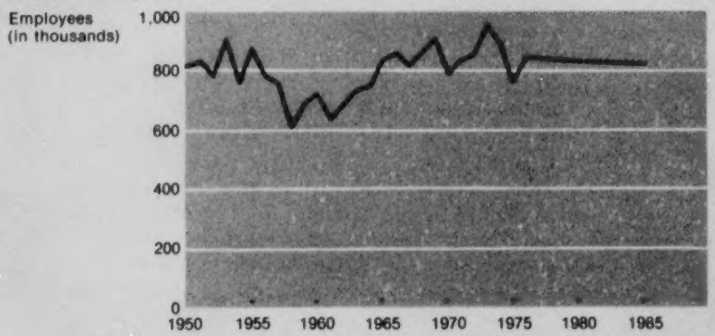
Some of the industry's increased efficiency, however, will be offset by other developments. For example, more workers will be needed to design, test, and build cars with improved safety, exhaust control, and fuel consumption features.

Changes in the kinds of vehicles built and how they are produced will affect the type as well as the number of workers employed in the automobile industry. More engineers, scientists, technicians, and other professionals will be employed to meet the industry's research and development needs, especially to design new engines, exhaust systems, and safety equipment. The use of computers will increase the need for systems analysts and programmers, but will limit employment growth in many clerical occupations.

The employment outlook for skilled workers in the industry varies by occupation. Little employment growth is expected for machinists and tool-and-die makers, for example, as more efficient metalworking processess are introduced. Some skilled occupations will grow, including electricians, millwrights, pipefitters, and machine repairers. Overall, the number of semiskilled workers will decline slightly.

Employment in motor vehicle manufacturing fluctuates with the economy, consumer preferences, credit availability, and defense activity

Wage and salary workers in motor vehicles and equipment manufacturing industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Earnings and Working Conditions

Production workers in the automobile industry are among the highest paid in manufacturing. In 1976 they averaged $7.10 an hour, compared to $5.19 an hour for production workers in all manufacturing industries.

Besides wages and salaries, automobile workers receive a wide range of fringe benefits. They are paid 1 1/2 times their normal wage for working more than 8 hours a day or 40 hours a week, or for working on Saturday. They receive premiums for working late shifts, and double the normal wage for Sundays and holidays. Most workers get paid vacations (or payment instead of vacations) and 12 paid holidays a year. Most companies provide annual wage increases, plus automatic increases when the cost of living rises. Life, accident, and health insurance are provided, also.

A great majority of the industry's workers are covered by company-paid retirement plans. Retirement pay varies with the length of service. Many plans provide for retirement at age 55, or after 30 years of service regardless of age.

Most wage workers and some salaried employees receive supplemental unemployment benefit plans, paid for entirely by their employers. These plans provide pay during layoffs and also provide short-workweek benefits when workers are required to work less than a full week. During layoff, provisions are included for life, accident, and health insurance; survivor income benefits; relocation allowances; and separation payments for those laid off 12 continuous months or more.

Most production maintenance workers in assembly plants, and a majority in parts plants, belong to the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America. In some parts plants, the International Union, Allied Industrial Workers of America is the bargaining agent. Other workers belong to the International Association of Machinists and Aerospace Workers; the Pattern Maker's League of North America; the International Molders' and Allied Workers' Union of North America; the Metal Polishers Buffers, Platers, and Helpers International Union; the International Union, United Plant Guard Workers of America (Ind.); the International Brotherhood of Electrical Workers; the International Union of Electrical, Radio, and Machine Workers; and the International Die Sinkers' Conference (Ind.).

Most automobile industry employees work in plants that are relatively clean and free of dust, smoke, and fumes. Some work areas, however, are hot, noisy, and filled with dust and fumes. These conditions have been greatly improved by the introduction of better ventilation and noise control systems.

Sources of Additional Information

Information on employment and training opportunities in the automobile industry can be obtained from local offices of the State employment service; employment offices of automobile firms; locals of the unions listed above; and from:

International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Ave., Detroit, Mich. 48214.

Motor Vehicle Manufacturers Association of the U.S., Inc., 320 New Center Building, Detroit, Mich. 48202.

Information on careers in automotive engineering and a list of schools offering automotive engineering courses are available from:

Society of Automotive Engineers, 2 Pennsylvania Plaza, New York, N.Y. 10001.

OCCUPATIONS IN THE NUCLEAR ENERGY FIELD

Nuclear energy is a source of heat and radiation that can be used for peaceful as well as military purposes. Although peaceful applications have been expanding rapidly in recent years, they are still in the early stages of development. Continuing research and development programs will be needed during the next several decades to find newer, safer, and more efficient ways of utilizing this energy.

In 1976, about 300,000 people worked in nuclear energy activities. Most were employed in the design and engineering of nuclear facilities and in the development and manufacture of nuclear weapons and nuclear reactors and their components. Many persons also were involved in research and development of nuclear energy. Most nuclear energy workers are scientists, engineers, technicians, and craftworkers.

Applications of Nuclear Energy

One significant use of nuclear energy is the production of electricity by nuclear reactors. Steam produced by reactors now generates electricity for many communities. These reactors have become competitive with systems that use fossil fuels (such as coal and oil). In early 1977, there were 65 nuclear reactors in commercial operation. About 170 plants were either in the planning stage or were being constructed. Dual-purpose nuclear power desalting plants, which would at the same time provide a new source of fresh water and electric power, are being studied.

Nuclear reactors also power submarines and surface vessels. By eliminating refueling, nuclear propulsion extends the range and mobility of our naval forces.

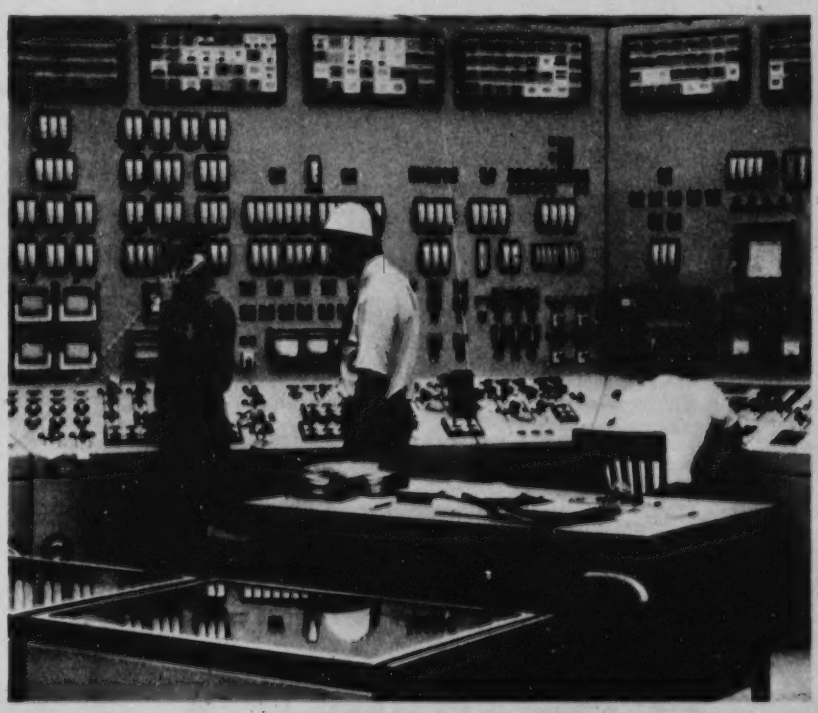
Although existing reactors already generate huge quantities of power from a small amount of uranium, more efficient reactors may be in operation by the mid-1980's. Further in the future, controlled fusion reactors may provide an even more efficient method of producing electricity.

Another significant application of nuclear energy is in the use of radioisotopes. Radioisotopes emit radiation that special instruments, such as thickness gauges, can detect and are valuable research tools in environmental studies, agriculture, medicine, and industry.

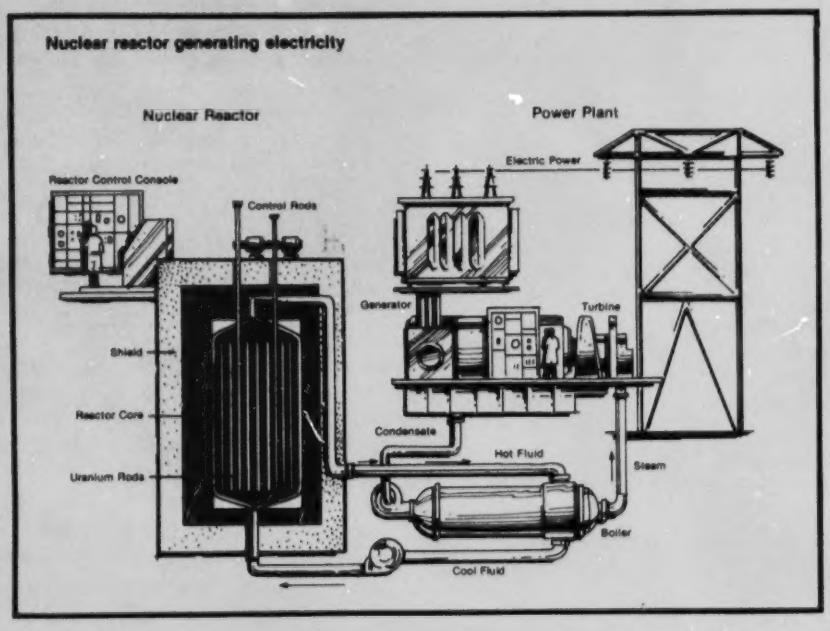
How Nuclear Energy Is Produced

Although there are several processes for producing nuclear energy, the most common method used today is the fission process. It involves splitting uranium or plutonium nuclei by neutron bombardment. When neutrons emitted from this fission process bombard other nuclei, further fission takes place and, under proper conditions, results in a "chain" reaction. This reaction releases energy that is converted into power. This energy can be controlled for commercial use.

Controlled fission is the essential feature of a nuclear reactor. The reactor is like a furnace, and needs fuel to operate. The principal source material for reactor fuel is uranium 235. Uranium in its natural state contains less than 1 percent of readily fissionable material, U-235. Although natural uranium sometimes is used as reactor fuel, a more concentrated and enriched fuel can be produced by increasing the proportion of U-235 isotopes through a process called gaseous diffusion. The rate of fission and energy produced in a nuclear reactor usually is controlled by inserting special neutron-absorbing rods into the fuel chamber or "core."



A section of a control room at a nuclear power plant.



When nuclear energy is used commercially for power, the heat generated must be converted to electricity by conventional power equipment. The major difference between nuclear and conventional thermal electric power stations is that the steam to drive turbines comes from a nuclear reactor rather than from conventional power sources. (See accompanying chart.)

Because of the potential hazards of nuclear radiation, special radiation-resistant materials are used in reactors, and extensive safety measures are taken to protect personnel.

Nature of the Nuclear Energy Field

Many kinds of research and industrial activities are required for the production and use of nuclear energy. These processes include the exploration, mining, milling, and refining of uranium-bearing ores; the production of nuclear fuels; the manufacture of nuclear reactors, reactor components, and nuclear instruments; the production of special materials for use in reactors; the design, engineering, and construction of nuclear facilities; the operation and maintenance of nuclear reactors; the disposal of radioisotopes; the production of nuclear weapons; and research and development work.

These activities take place in various types of facilities. Some work, such as mining and milling, manufacturing heat transfer equipment, and constructing facilities, differs little from similar work in other fields. Other activities, however, such as producing fuels needed to run reactors, are unique to the nuclear energy field.

The Federal Government supports about half of the basic nuclear energy activities, although private support has been increasing. The U.S. Energy Research and Development Administration (ERDA) directs the Federal Government's nuclear energy research program, and the Nuclear Regulatory Commission (NRC) controls the use of nuclear materials by private organizations. The operation of ERDA-owned facilities, including laboratories, uranium processing plants, nuclear reactors, and weapons manufacturing plants, is contracted to private corporations. Most of these operations involve research into the expansion of medical and industrial applications of nuclear energy and the advancement of reactor technologies for generating electricity. Production of nuclear materials for civilian needs is also done in some of these facilities.

Privately owned facilities do all types of nuclear energy work except for the development and production of military weapons and certain nuclear fuel-processing operations. Some research is carried out independently by colleges and universities and by nonprofit organizations.

Occupations in the Nuclear Energy Field

Engineers, scientists, technicians, and craftworkers account for a higher proportion of total employment in this field than in most others, mainly because much of the work is still in the research and development phase. Office personnel in administrative and clerical jobs represent another large group. Most of the remainder are semiskilled and unskilled workers involved in production operations, plant protection, and services.

Although many engineers working in the nuclear energy field are trained in nuclear technology, engineers trained in other branches also are employed. Mechanical engineers are the largest single group, but many electrical and electronic, chemical, civil, and metallurgical engineers also work in this field. Many of these engineers do research and development work; others design nuclear reactors, nuclear instruments, and other equipment.

Research laboratories and other organizations that do nuclear energy work employ scientists in basic and applied nuclear research. Most are physicists and chemists, but mathematicians, biological scientists, and metallurgists also do nuclear energy research.

Large numbers of engineering and science technicians, drafters, and radiation monitors assist the engineers and scientists in conducting research and in designing and testing equipment.

Many highly skilled workers build equipment for experimental and pilot work and maintain the complex equipment and machinery. Many maintenance mechanics and all-round machinists work in most nuclear energy activities, as do electricians, plumbers, pipefitters, and oth-

er craftworkers and chemical-process operators.

Activities in the Nuclear Energy Field

The following sections briefly describe some major nuclear energy activities and their workers.

Uranium Exploration and Mining. The 9,500 people employed in uranium exploration and mining in 1976 had jobs similar to those in mining of other metallic ores. They mainly work in the Colorado Plateau area of the Far West, in the States of New Mexico, Wyoming, Utah, Colorado, and Arizona. A relatively small number of mines account for the bulk of production and employment. Most workers in uranium mines are in production jobs. Among them are miners and drillers in underground mines and truckdrivers, bulldozer operators, and machine loaders at open pit mines. Scientists and engineers—mining engineers, geologists—also work in uranium exploration and mining.

Uranium Ore Milling. In uranium mills, metallurgical and chemical processes are used to extract uranium from mined ore. Uranium mills, located primarily in the Colorado Plateau, employed about 1,700 workers in 1976.

These mills employ skilled machinery repairers, millwrights, pipefitters, carpenters, electricians, and chemical-process operators. A small proportion of those working in milling operations are scientists and engineers.

Uranium Refining and Enriching. Milled uranium is chemically processed to remove impurities and is then converted to metal or intermediate chemical products for reactor fuel preparation. Conventional chemical and metallurgical processes are used, but they must meet more exacting standards than in most other industries. The output of refining plants may be further processed to obtain enriched uranium.

Activity in this segment of the nuclear energy field is centered in Ohio, Tennessee, Kentucky, and Illinois. In 1976 uranium refining and enriching plants employed about 11,800 workers.

Maintenance craftworkers, particularly in the highly automated uranium enriching plants, constitute a large proportion of skilled workers in this area. Many chemical-process operators also are employed. More than one-third of the engineers and scientists are chemical engineers and chemists.

Reactor Manufacturing. About 27,800 people were employed in the design and manufacture of nuclear reactors and reactor parts in 1976. Reactor manufacturers do extensive development work on reactors and auxiliary equipment and generally build most of the intricate components, such as fuel elements, control rods, and reactor cores.

Over one-third of the employees in firms that design and manufacture reactors are scientists, engineers, and technicians. Engineers alone represent nearly one-quarter of the employment. Most are mechanical engineers and engineers who specialize in reactor technology. Assisting these engineers and scientists are many drafters and engineering technicians. Reactor manufacturers employ skilled workers, mostly all-round machinists, in experimental, production, and maintenance work. Nuclear reactor operators also are employed to operate experimental and test reactors.

Reactor Operation and Maintenance. About 13,000 workers operated and maintained nuclear reactors in 1976. Nuclear power stations employ reactor operators, mechanical, electrical and electronic engineers, instrument and electronic technicians, and radiation monitors. Machinery and instrument repairers, electricians, and pipefitters maintain and repair the reactors.

Research and Development Facilities. A number of research and development laboratories are operated for ERDA by universities and industrial concerns. These facilities are major centers for basic and applied nuclear research in engineering, in physical and life sciences, and in the development of nuclear reactors and other nuclear equipment. More than half of the 30,000 employed in ERDA research and development facilities are engineers, scientists, and supporting technicians, including radiation monitors.

Although most nuclear energy research is done in ERDA research and development facilities, about 2,600 persons conducted research in privately owned laboratories of educational institutions, other nonprofit institutions, and industrial concerns in 1976. Nearly 3 out of 4 were in scientific, engineering, and technical jobs.

Production of Nuclear Weapons and Other Defense Materials. Establishments producing nuclear weapons, weapon components, and other defense materials employed about 32,700 persons in 1976. Among the large number of scientists and engineers employed at these facilities are physicists, chemists, and mechanical, electrical, and electronic engineers. Many engineering and physical science technicians, drafters, and radiation monitors assist scientists and engineers.

Construction of Nuclear Facilities. In 1976, about 66,000 persons worked on the construction of nuclear facilities—most were craftworkers. About 18,000 of these were pipe- and steamfitters, 8,100 were electricians, and 11,200 were laborers. Several thousand carpenters, ironworkers, operating engineers, and boilermakers also were required in nuclear construction.

Other Nuclear Energy Activities. About 2,400 workers produced special materials such as beryllium, zirconium, and hafnium for use in reactors in 1976. About 8,500 workers were employed in companies that made reactor control instruments and radiation detection and monitoring devices. Large numbers of engineers and technicians are employed in these industries.

About 6,900 people were involved in the design, construction, or operation of particle accelerators used in

nuclear research. Particle accelerators enable scientists to study the structure and properties of elementary particles in the nucleus of an atom.

Other workers process and package radioisotopes, produce radiography units and radiation gauges, and package and dispose of radioactive waste.

Government Employment. In 1976, the Energy Research and Development Administration (ERDA) employed nearly 7,000 workers who were involved in nuclear energy activities. The Nuclear Regulatory Commission (NRC) employed about 2,500 persons. Since ERDA and NRC are primarily administrative and regulatory agencies, nearly 9 out of 10 employees are in administrative, professional, or clerical jobs. Several thousand employees are engaged in nuclear energy work in other Federal agencies and in regulatory activities and radiological health programs of State and local governments.

Unique Nuclear Energy Occupations. Most of the occupations discussed in the preceding sections are similar to those found in other industrial activities, even though they may have job titles unique to the nuclear energy field (such as nuclear engineer, radiation chemist, and nuclear physicist) and require some specialized knowledge of nuclear energy. (A detailed discussion of the duties, training, and employment outlook for most of these occupations appears elsewhere in the *Handbook.*)

The health physics occupations and some other occupations that are unique to the nuclear energy field and require specialized training are discussed briefly in the following sections.

Health physicists (sometimes called radiation or radiological physicists or chemists) detect radiation and apply safety standards to control exposure to it. In 1976, about 650 health physicists were employed in radiation protection work, research, or teaching.

Health physicists are responsible for planning and organizing radiological health programs at nuclear energy facilities. They establish inspection standards and determine procedures for protecting employees and eliminating radiological hazards. Some supervise the inspection of work areas with potential radiation hazards and prepare instructions covering safe work procedures.

Health physicists also plan and supervise training programs dealing with radiation hazards and advise others on methods of dealing with them. In some cases, they work on research projects dealing with the effects of human exposure to radiation and may develop procedures for using radioactive materials.

Radiation monitors (also called health-physics technicians) generally work under the supervision of health physicists. About 1,900 radiation monitors were employed in 1976. They use special instruments to monitor work areas and equipment to detect radioactive contamination. Soil, water, and air samples are taken frequently to determine radiation levels. Monitors also may collect and test radiation detectors worn by workers, such as film badges and pocket detection chambers, to ensure that they are functioning properly. Monitors calculate the amount of time that personnel may safely work in contaminated areas, considering maximum radiation exposure limits and the radiation level. They also give instructions in radiation safety procedures and prescribe special clothing requirements and other safety precautions for workers entering radiation zones.

Nuclear reactor operators perform work in nuclear power stations similar to that of boiler operators in conventional power plants; however, the controls they operate are different. They also help to load and unload nuclear fuels used in reactors. Those who work with research and test reactors check reactor control panels and adjust the controls to maintain specified operating conditions within the reactor. About 2,100 people worked as nuclear reactor operators in 1976.

Accelerator operators set up, maintain, and coordinate the operation of particle accelerators. They adjust machine controls to accelerate electrically charged particles, based on instructions from the scientist in charge of the experiment, and set up target materials that are to be bombarded by the particles.

Radiographers take radiographs to check the condition of metal castings, welds, and other objects by exposing them to a source of radioactivity such as X-rays or gamma rays. They select the proper type of radiation source and film and use standard mathematical formulas to determine exposure distance and time. After processing the radioactive film, the radiographer is able to discover cracks and weaknesses in the object radiographed so that it may be repaired.

Hot-cell technicians operate remote-controlled equipment to test radioactive materials that are placed in hot cells—rooms enclosed with radiation shielding materials such as lead and concrete. By controlling "slave manipulators" (mechanical devices that act as a pair of arms and hands) from outside the cell and observing their actions through the cell window, they perform standard chemical and metallurgical operations with radioactive materials. Hot-cell technicians also enter the cell wearing protective clothing to set up experiments or to decontaminate the cell and equipment. This classification is divided into several groups. *Decontamination workers* use radiation-detection instruments to locate plant areas and materials that have been exposed to radiation and decontaminate them with special equipment, detergents, and chemicals. They also verify the effectiveness of the process. *Waste-treatment operators* operate heat exchange units, pumps, compressors, and other such equipment to decontaminate and dispose of radioactive wastes. *Waste-disposal workers* seal contaminated wastes in concrete containers and transport the containers to be buried underground.

Radioisotope-production operators use remote control manipulators and other equipment to prepare radioisotopes for shipping and to perform chemical analyses to ensure that radioisotopes conform to specifications.

Employees inspect one of the fuel elements in a nuclear reactor at an electric company plant.

Training and Other Qualifications

Training and education requirements and advancement opportunities for most workers in the nuclear energy field are similar to those doing comparable jobs in other industries. These are discussed elsewhere in the *Handbook* under the specific occupations. However, additional specialized training is required for many workers because the field requires exacting work standards in both its research and production activities, and because it has unique health and safety problems.

Many engineers and scientists in the nuclear energy field have advanced training, particularly those doing research, development, and design work. Some employers require a Ph.D. degree. In some jobs, an advanced degree is not required but it often increases one's advancement opportunities.

The specialized knowledge of nuclear energy essential for most scientific and engineering positions can be obtained at a college or university or through on-the-job experience. Many colleges and universities have expanded their facilities and curriculums to provide training in nuclear energy. Most persons planning to work in the nuclear energy field as scientists and engineers choose to major in a specific nuclear discipline, although a degree in a traditional engineering or science curriculum often is sufficient to begin work in the field. Some colleges and universities award graduate degrees in nuclear engineering or nuclear science. Others offer some graduate courses in these fields, but award degrees only in the traditional engineering or scientific fields.

Health physicists should have at least a bachelor's degree in physics, chemistry, or engineering, and a year or more of graduate work in health physics. A Ph. D. degree often is required for teaching and research.

Skill requirements for craftworkers in the nuclear energy field are higher than in most industries because of the precision required to insure efficient operation and maintenance of complex equipment and machinery. For example, pipefitters may have to fit pipe to tolerances of less than one ten-thousandth of an inch and work with pipe made from rare and costly metals. Welding also must meet higher reliability standards than in most fields. These craftworkers generally obtain the required additional specialized skills through apprenticeship training programs of employers and unions.

High school graduates who have taken science courses can qualify for on-the-job training as radiation workers, accelerator operators, radiographers, hot-cell technicians, decontamination workers, radioisotope-production operators, and radioactive waste disposal workers.

Nuclear power reactor operators need a basic understanding of reactor theory and a working knowledge of reactor controls. Most operator trainees are high school graduates. Some receive specialized training, either through a technical school or through training programs in the military service. Many trainees are selected from conventional power plant personnel with experience operating boilers, turbines, or electrical machinery. Workers operating nuclear reactor controls must be licensed by the Nuclear Regulatory Commission. To qualify for a license, the trainee must pass an operating and written test given by the NRC, along with a medical examination. The preparation for NRC licensing generally lasts at least 1 year. Licenses must be renewed every 2 years, however, due to rapid technological change. Consequently, continual training is necessary. Additional preparation beyond the operator's license is needed for a senior operator's license, which authorizes the holder to supervise a nuclear control room.

All employees who work in the vicinity of radiation hazards are given on-the-job training in the nature of radiation and the procedures to follow in case of its accidental release.

Individuals who handle classified data (restricted for reasons of national security) or who work on classified projects in the nuclear energy field must pass a security clearance.

The Energy Research and Development Administration, at its contractor-operated facilities, supports on-the-job and specialized training programs to help prepare scientists, engineers, technicians, and other workers for the nuclear energy field.

Additional educational and training opportunities are offered in cooperative programs arranged by ERDA laboratories with colleges and universities. Temporary employment at these laboratories is available to faculty members and students. Many undergraduate and graduate engineering students work at laboratories and other ERDA facilities on a rotation basis, and many graduate students do their thesis work at ERDA laboratories.

Government contractors often provide employees with training at their own plants or at nearby colleges and universities.

Employment Outlook

Employment in the nuclear energy field is likely to grow much faster than the average for all industries through the mid-1980's. However, much public concern exists regarding the safety and environmental effects of the use of nuclear power. Continued controversy in this area could result in a slower rate of industrial growth than initially anticipated.

Expansion of nuclear generating capacity and continued increases in research and development expenditures should account for most of the growth in the field. Besides the job openings created by employment growth, many openings will occur as workers retire, die, or transfer to other occupations or industries.

The number of nuclear power plants is expected to be several times greater in 1985 than it was in 1976. This anticipated growth will require large increases in the number of workers in the design, construction, operation, and maintenance of these plants. In design, many more engineers and drafters will be required. Construction needs will call for large numbers of craftworkers and laborers. Many more nuclear reactor operators and maintenance personnel will be needed to bring these plants into operation and keep them running efficiently.

Expansion will require substantial employment increases in the sectors involved in mining and milling uranium ore, processing reactor fuel, and producing special materials for reactors. Also, because of the concern about the possible health hazards of nuclear radiation, increasing numbers of persons involved in reactor and personnel safety, such as health physicists and radiation monitors, should be needed.

Employment associated with research and development also is expected to increase, though not as fast as in the areas directly affected by nuclear construction. An increasing number of scientists, engineers, and technicians will study methods to improve the efficiency of the nuclear generation of electricity, peaceful uses for nuclear explosives, and the possible bio-medical applications of nuclear science.

Earnings and Working Conditions

Hourly earnings of production workers employed by contractors at ERDA laboratories and other installations averaged $6.21 in 1976, compared with $5.19 for those in all manufacturing industries.

Scientists and engineers employed at ERDA installations averaged $21,700 a year in 1976. Clerical personnel earned an average of $5.15 an hour while technicians averaged about $6.55 an hour. (Earnings data for many of the occupations found in the nuclear energy field are included in the statements on these occupations elsewhere in the *Handbook*.)

Working conditions for most workers in the nuclear energy field generally are similar to those in other industries, except for radiation safety precautions. For instance, all uranium mines are equipped with mechanical ventilation systems that reduce the concentration of radioactive radon substance that may cause lung injury if inhaled over a number of years. Efforts to eliminate this hazard are continuing. Manufacturing facilities, power plants, and research laboratories are generally well-lighted and well-ventilated. Only a small proportion of employees in the nuclear energy field actually work in areas where direct radiation dangers exist. Even in these areas, shielding, automatic alarm systems, and other devices and clothing give ample protection to the workers.

Extensive safeguards and operating practices protect the health and safety of workers, and ERDA and its

contractors have maintained an excellent safety record. The NRC regulates the possession and use of radioactive materials, and inspects nuclear facilities to insure compliance with health and safety requirements. Constant efforts are being made to provide better safety standards and regulations.

Most hourly paid plantworkers belong to unions that represent their particular craft or industry.

Sources of Additional Information

Information about research programs in the nuclear energy field is available from:

U.S. Energy Research and Development Administration, Washington, D.C. 20545.

For information about licensing and safety requirements, contact:

U.S. Nuclear Regulatory Commission, Washington, D.C. 20555.

OFFICE MACHINE AND COMPUTER MANUFACTURING OCCUPATIONS

During the last decade, employment in the office machine and computer industry grew much faster than employment in manufacturing as a whole. Growth was spearheaded by a rapid expansion in the production of computers. For many years, the industry's chief products were typewriters, adding machines, calculators, and other conventional office machines. Today, plants that make computers and related equipment account for about three-fourths of the industry's production.

Nature and Location of the Industry

In 1976, the office machine and computer manufacturing industry employed 290,000 workers in approximately 1,050 plants. About 6 out of every 10 of them worked in plants that produced computer equipment, the remainder in plants that produced conventional office machines and scales and other weighing devices.

Computer equipment manufacturing plants employed about 195,000 workers in 1976. These plants manufacture general purpose computers as well as those used for special applications, such as space exploration and missile guidance. They also manufacture related equipment such as machines that read magnetic numbers on bank checks. In addition to computers and related equipment, plants may furnish "software" (computer programs and operating systems that control the operation of the computer). Thousands of people whose employment is not included in this chapter are employed outside manufacturing plants by firms that specialize in software or that rent or lease computers and provide related services.

In 1976, about 95,000 people were employed in factories that produced conventional office machines and scales. Of this total, nearly half produced desk calculators, cash registers, coin and ticket counters, and adding, accounting, and voting machines; the rest produced typewriters, industrial and household scales and miscellaneous office machines, including items as diverse as postage meters and dictating machines.

Large plants account for most of the employment in office machine and computer manufacturing. About 65 percent of the industry's employees work in plants that have 1,000 or more employees; several computer plants have more than 5,000 employees.

Six of every 10 persons employed in computer manufacturing work in California, New York, and Minnesota, and the following States employ most of the remainder: Massachusetts, Pennsylvania, Colorado, Florida, Texas, Arizona and North Carolina. In New York, the lower Hudson River Valley area has many important computer manufacturing centers: Poughkeepsie, East Fish Kill, and Kingston. Large manufacturing plants also are located in Utica, N.Y., and in the Boston, Mass., and Philadelphia, Pa. areas. The leading center in the Midwest is Minneapolis-St. Paul. The Los Angeles and San Diego industrial areas are the most important computer manufacturing centers in the West, followed by Phoenix, Ariz.; and San Jose, Calif.

Most of the conventional business machine manufacturing employment is located in eight States: Ohio, Kentucky, New York, Michigan, California, Illinois, New Jersey, and Connecticut. Some of the important manufacturing centers are: Dayton, Toledo, and Euclid, Ohio; the New York-Northeastern New Jersey industrial area; Hartford and Stamford, Conn.; Chicago, Ill.; Detroit, Mich.; and Lexington, Ky.

Occupations in the Industry

A variety of occupations, requiring a broad range of training and skills, are found in plants that make office machines and computers. More than half of the industry's workers are in white-collar jobs (engineering, scientific, technical, administrative, sales, and clerical); the others are in plant jobs (assembly, inspection, maintenance, transportation and service).

White-collar workers represent a significantly larger proportion of total employment in the computer industry than in most other manufacturing industries because of the highly complex nature of computer manufacturing.

Some of the key occupations in the office machine and computer industry are described briefly in the following section. (Detailed discussions of professional, technical, skilled, and other occupations found in this industry, as well as in many others, are presented elsewhere in the *Handbook*, in sections covering individual occupations.)

Engineering and Scientific Occupations. Nearly 1 out of every 10 workers in the office machine and computer industry is an engineer or scientist. Most of them work at computer plants.

The largest group of engineers work with electricity or electronics. Most are engaged in research and development, although many work in production. The industry also employs large numbers of mechanical and industrial engineers. Some mechanical engineers are engaged in product development and tool and equipment design. Others are concerned with the maintenance, layout, and operation of plant equipment. Industrial engineers determine the most effective means of using the basic factors of production—labor, machines, and materials.

Chemists make up the largest group of scientists in office machine and computer manufacturing. Their work is primarily in chemical pro-

cessing of printed circuits used in computers. Mathematicians make up another large group of scientists. Their work on complex mathematical problems is important in designing computers. Physicists are employed in research and development to work on items such as miniaturized components and circuits. Statisticians work in fields such as quality control and production scheduling.

The industry also employs systems analysts and computer programmers, many of whom have scientific or engineering backgrounds. Systems analysts primarily devise new information processing techniques and improve existing techniques. Programmers design and test computer programs. Some analysts and programmers specialize in scientific and engineering problems, while others process accounting, inventory, sales, and other business data. In addition, systems analysts and programmers may assist sales personnel in determining data processing needs of customers.

Technical Occupations. More than 1 out of every 20 workers in the industry is a technician. Most specialize in electronics and assist engineers and scientists in research and development, testing and inspecting electronic components, and doing complex assembly work. Some electronics technicians specialize in repairing computers. Chemical control technicians prepare solutions used in the etching of circuit boards. Photographic technicians set up cameras and other equipment used in the tracing process to create copper etchings on circuit boards. Drafters prepare drawings from sketches or specifications furnished by engineers. Engineering aides assist engineers by making calculations, sketches, and drawings, and by conducting performance tests on components.

Administrative and Sales Occupations. About 1 out of every 13 workers is an administrator. Included are top executives who manage companies and determine policy decisions and middle managers who direct departments such as advertising and industrial relations. Other administrative employees in staff positions include accountants, lawyers, and market researchers.

Sales personnel hold about 1 out of every 25 jobs in the industry. Those who sell conventional office machines usually work on their own. Computer sales personnel, on the other hand, are assisted by a host of technical experts, such as engineers and systems analysts. Because computers are complex and expensive, computer sales representatives may have to spend several months to complete a sale.

Clerical Occupations. Nearly 1 out of every 6 workers in the industry is in a clerical job. Included in this group are secretaries, clerk typists, file clerks, bookkeepers, and business machine operators, as well as computer personnel such as keypunch and computer operators.

Plant Occupations. Nearly half of this industry's employees are plant (blue-collar) workers. Most plant workers are engaged directly in making computers and office machines. They include assemblers, inspectors or testers, machinists, machine tool operators, and their supervisors. Truckdrivers, material handlers, power truck operators, guards, and janitors move materials and perform custodial duties, and plumbers and pipefitters, electricians, carpenters, and other workers maintain production machinery and building facilities.

Assembly Occupations. (D.O.T. 706.884, 726.781 and .884) Workers who assemble computers and office machines have many different skills, and make up the largest group of plant workers.

Assemblers may put together small parts to make components or components to make sub-assemblies or the finished product. Much of their work is done by hand. Some assemblers do a single operation as components move down the assembly line. The assembly of typewriters, for example, is divided into many simple operations. Each assembler does one job as the typwriter passes the work station. Some assembly jobs are difficult and require great skill, while others are relatively simple. Skilled electronics assemblers, for example, use diagrams as guides to wire complex memory and logic panels for computers.

Machines are used for many assembly operations. Automatic wire-wrapping machines, for example, wire panels and plug-in-boards. Operators feed these machines and remove and inspect finished items.

Electronic technicians usually do the most difficult hand assembly work. In research laboratories, they put together experimental equipment. In plants, they put together complex items that require a knowledge of electronics theory.

Assemblers commonly use screwdrivers, pliers, snippers, and soldering irons and they use special devices to position and hold parts during assembly. Some assemblers use precision equipment to weld connections in circuit assemblies.

Machining Occupations. Most office machine and computer manufacturing plants employ machining workers who operate power-driven machine tools to produce plastic and metal parts for computers, typewriters, accounting machines, calculators, and other products. Numerical control machine operators tend machines that have been programmed to perform machining operations automatically. Toolmakers construct and repair equipment used to make and assemble parts. Diemakers specialize in metal forms (dies) used in punch and power presses that shape metal parts.

Inspection and Testing Operations. These operations begin when raw materials enter the plant and continue throughout the assembly process. Finished parts and products are tested and inspected thoroughly.

Some inspectors examine individual parts; others inspect components during subassembly; still others inspect completed office machines and computers. Many inspecting jobs require highly skilled workers. On the other hand, relatively unskilled people can run some automatic test equipment. Workers who feed or monitor this equipment are called test-set operators or testing machine operators.

Job titles indicate the work many inspectors do. *Machined parts inspectors* (D.O.T. 609.381) use precision testing instruments to determine whether parts have been machined properly. *Type inspectors* (D.O.T. 706.687) use a magnifying glass to examine typewriter type for defects. *Electronic subassembly inspectors* (D.O.T. 726.384) use microscopes, meters, and various measuring devices to examine circuits and other electronic subassemblies. *Electronic assembly inspectors* (D.O.T. 722.281) use special instruments to test electronic systems such as computer memory units.

In plants that manufacture conventional office machines, final inspection is relatively simple. Inspectors operate the machines, look for defects, and refer malfunctioning machines to repairers. The final inspection or "debugging" of computers, on the other hand, is very complex. Electronic technicians inspect new computers under the supervision of electronic engineers. They use complex equipment to run tests and detailed drawings and instructions to find causes of malfunctions.

Maintenance Occupations. Many maintenance workers with different types of training take care of the industry's production machinery and equipment. Skilled electricians are responsible for the maintenance of electrical equipment. Machine and equipment repairers make mechanical repairs. Maintenance machinists and welders build and repair equipment. Air-conditioning and refrigeration mechanics are employed in plants that are air-conditioned and have special refrigerated and dust-free rooms in order to maintain the equipment. Painters, plumbers, pipefitters, carpenters, and sheet-metal workers, and other building maintenance craft workers also are employed in this industry.

Other Plant Occupations. Many truckdrivers are employed to make deliveries to various parts of plants. Laborers load and unload trucks and boxcars and do general clean-up work. Some other plant occupations are boiler operator, stationary engineer, guard, and janitor.

Training, Other Qualifications, and Advancement

A bachelor's degree in engineering or one of the sciences is usually required for engineering and scientific jobs. For research and development work, applicants with advanced degrees generally are preferred. Some companies have training programs designed to give newly hired college graduates a broad picture of manufacturing operations before they are assigned to a particular department. Because of the highly technical nature of computers, many of the industry's executives have backgrounds in engineering or science.

Engineers and scientists, as well as persons with a degree in computer science, are employed as sales workers, programmers, and systems analysts. Most business and liberal arts graduates are employed in accounting, personnel, and other administrative activities.

Technicians qualify for their jobs in a number of ways. Some obtain training in either public, private, or Armed Forces technical schools. Others have one or more years of scientific or engineering training, but have not completed all of the requirements for a degree. Still other technicians are promoted from lower grade jobs in the plant and some well-qualified technicians may advance to engineering jobs after completing courses in mathematics, engineering, and related subjects.

People who complete commercial courses in high school or business school are preferred in clerical jobs such as secretary or office machine operator. For computer operators, most firms prefer applicants who have some college or technical training in data processing. With additional training, some computer operators and clerical workers advance to programmer jobs.

In selecting workers for plant jobs, firms generally prefer high school or vocational school graduates, who are then trained through on-the-job instruction and experience that varies from a few days to years. Some plants also conduct classroom training of short duration. Skilled craft workers, such as machinists and tool and die makers, may spend 3 to 4 years in learning their jobs and some firms have formal apprenticeship programs, which include both on-the-job training and classroom instruction related to the particular craft. Frequently, openings for skilled jobs are filled by workers already in the plant.

Workers who have little or no previous experience or training are hired for less skilled inspection, assembly, and machining jobs. Applicants may have to pass aptitude tests and demonstrate ability for particular types of work. Most assembly and inspection jobs require good eyesight and color perception, manual dexterity, and patience.

Experienced plant workers have opportunities to advance to jobs with higher pay. Assemblers, for example, can become semiskilled inspectors, and eventually skilled inspectors. Machine tool operators can move to skilled machinist jobs. Craft workers and skilled inspectors can become technicians, after completing courses in company-operated schools, junior colleges, or technical schools. Supervisory jobs are open to experienced plant workers who have leadership ability.

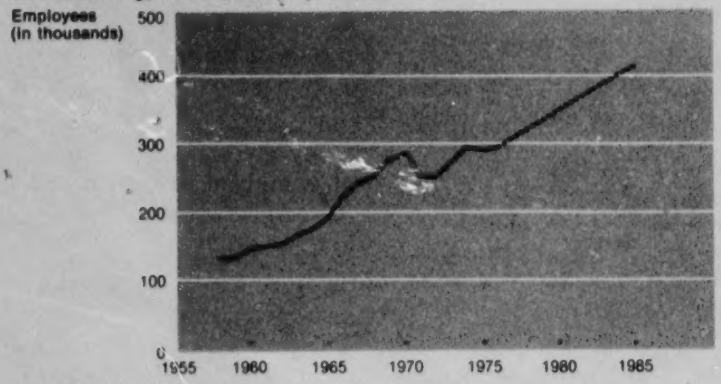
Employment Outlook

Employment in this industry is expected to increase faster than the average for all industries through the mid-1980's. This growth is projected to occur principally in plants that produce electronic computer equiment; little growth is forseen among manufacturers of conventional office equipment. In addition to the job openings that result from employment growth, many openings will arise as experienced workers retire, die, or transfer to jobs in other industries.

The demand for computers and related equipment is expected to increase rapidly as computers are used to solve an increasing array of problems in business, industry, and government. Using computers to control the flow of automobile traffic, to aid physicians make a medical diagnosis, and to help students learn more quickly are just a few of the new computer applications that are likely to come into widespread use over the next few years. In addition to growth generated by new applications, de-

Very rapid employment growth is expected in plants that produce electronic computer equipment

Wage and salary workers in office and computing machine manufacturing, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

mand will rise as further price reductions bring a computer system within reach of more and more small organizations. Growth in the number of computers will be accompanied by a need for additional computer-related equipment—input and output, storage, and communication devices—as well as software designed specifically to meet the needs of certain types of organizations.

Although the demand for conventional office machines is expected to remain strong through the mid-1980's, employment in plants that produce this type of equipment will grow slowly. Most job openings will result from the need to replace experienced workers who retire, die, or transfer to other industries. The demand for office equipment should continue to rise as business and government organizations grow and the volume of paperwork increases. However, technological improvements in production methods are expected to increase output per worker. For example, increasing mechanization of operations formerly done by hand will tend to reduce labor requirements, particularly in plants where products are mass-produced, such as typewriters and calculators.

Some occupational groups in the office machine and computer manufacturing industry are expected to grow faster than others. For example, the number of professional and administrative workers, particularly engineers, scientists, and technicians, is expected to increase more rapidly than the number of plant workers. Demand for these workers will be spurred by continued high levels of research and development expenditures to improve machine capabilities, design more efficient software, and develop new applications for computers.

Semiskilled workers, such as assemblers and inspectors, will continue to account for most of the work force in production occupations, despite the growing use of automated and mechanized assembly line equipment.

Earnings and Working Conditions

In 1976, plant workers in the office machine and computer industry had average earnings of $5.29 an hour. Wages in computer manufacturing plants are slight higher than in the industry as a whole, averaging $5.46 an hour in 1976.

National wage data are not available for individual occupations in the office machine and computer industry. However, the following tabulation, based on data obtained from a small number of union contracts, provides an example of the range in hourly wage rates for selected occupations in 1976:

	Hourly rate ranges
Assemblers	$3.00–4.50
Machinists	4.38–5.82
Tool-and-die makers	5.50–6.50
Electricians	5.50–6.50

Some employees work night shifts and weekends because many plants operate around the clock. Employees working second or third shifts, or more than 8 hours a day or 40 hours a week generally receive extra pay.

Paid vacations and holidays are almost universal in this industry. Most employees receive 1 to 4 weeks of vacation, depending on length of service. They also receive insurance and pension benefits at least partially financed by the employer. Employee stock purchase plans are available in many firms.

In general, the work surroundings in office machine and computer plants are more favorable than those in most other types of factories. Work stations usually are well-lighted and clean, and free from dust, fumes, and loud noises. Many computer factories are relatively new and are located in suburban areas.

Some plant jobs are repetitious, but very few require great physical effort. Fewer and less severe injuries take place in office machine and computer manufacturing than the average for all manufacturing.

Many plant workers are covered by union contracts. The principal unions in this industry are the International Association of Machinists and Aerospace Workers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the International Brotherhood of Electrical Workers.

Sources of Additional Information

For general information on jobs in the industry, write to:

American Federation of Information Processing Societies, Inc., 210 Summit Ave., Montvale, N.J. 07645.

OCCUPATIONS IN THE PAPER AND ALLIED PRODUCTS INDUSTRIES

In 1976, the paper and allied products industry employed about 676,000 people to produce many different kinds of paper and paperboard products. The industry employs workers in occupations ranging from unskilled to highly specialized technical and professional jobs, many found only in the paper industry.

Nature and Location of the Industry

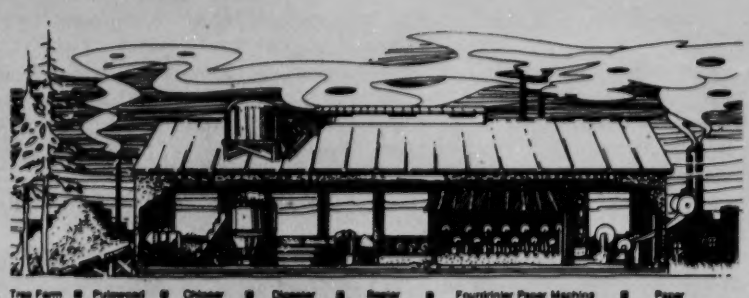
The paper industry is highly mechanized. Pulp, paper, and many finished paper products are manufactured by machines—some as long as a football field—in a series of nearly automatic operations that require very little handling of materials by workers. Manufacturing plants in the paper industry are engaged in one or more of three different operations: The production of pulp (the basic ingredient of paper) from wood, reused fibers, or other raw materials; the manufacture of paper or paperboard (thick paper) from pulp; or the conversion of rolls or sheets of paper or paperboard into finished products, such as tissue paper, envelopes, and boxes.

The largest group of employees in the industry work in mills that produce pulp, paper, or paperboard. The next largest group works in plants that make boxes and containers; and the remainder work in plants that make a variety of other paper products.

About four-fifths of the industry's employees work in factories that employ 100 workers or more.

Workers in this industry are located throughout the country, although about half are employed in eight States: New York, Pennsylvania, Illinois, Ohio, Wisconsin, Massachusetts, California, and New Jersey.

The papermaking process



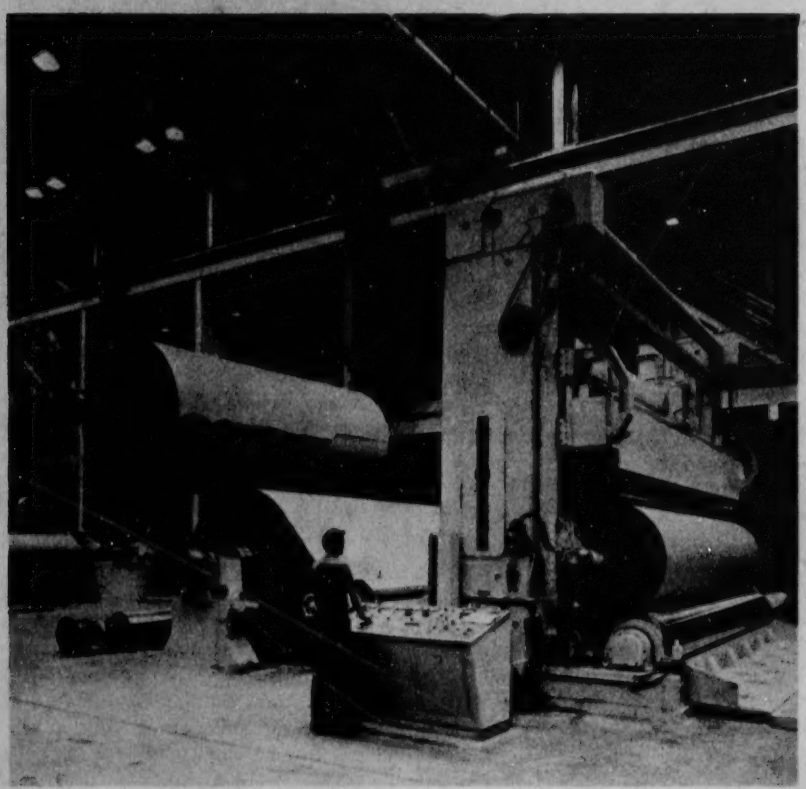
Occupations in the Industry

Employees in the paper industry work in a variety of occupations requiring a broad range of training and skills. Many workers operate and control specialized papermaking, finishing, and converting machines. Some workers install and repair papermaking machinery. Truck drivers make deliveries, and other workers load and unload trucks, railroad cars, and ships.

The industry employs many workers in clerical, sales, and administrative occupations. For example, it employs purchasing agents, personnel managers, sales representatives, office clerks, stenographers, bookkeepers, and business machine operators. Also, because of the complex processes and equipment used, the industry employs professional and technical workers, including chemical and mechanical engineers, chemists, laboratory technicians, and pulp and paper testers. (Detailed discussions of professional, technical, and mechanical occupations, found not only in the paper industry but in other industries, are given elsewhere in the *Handbook* in sections covering individual occupations.)

Production Jobs. In 1976, more than three-fourths of all employees in the industry worked in production jobs. The simplified description of papermaking occupations and processes that follows applies to a plant which combines the production of pulp, paper, and finished paper products into one continuous operation. (See accompanying chart.)

After trees are cut down, loggers will saw off the limbs and saw the trunk into logs. The logs are then transported to the pulp mill where the bark is removed. One machine used for this operation is a large revolving cylinder known as a "drum barker." Logs are placed on a conveyor belt and fed into this machine by a semiskilled worker called a *barker operator* (D.O.T. 533.782). The machine cleans bark from the logs by tumbling them against each other and also against the rough inner surface of the drum. Next, pulp fibers in the logs are separated from other



The paper industry is highly mechanized.

substances by a chemical or mechanical process, or both, depending on the type of wood used and the grade of paper desired.

In the mechanical process, pulpwood is held against a fast-revolving grindstone that separates the fibers. In the more commonly used chemical process, pulpwood is carried on conveyor belts to a chipper machine operated by a *chipper* (D.O.T. 668.885). The machine cuts the pulpwood into chips about the size of a quarter.

In recent years, a larger number of mobile harvesters and chippers have been used to chip whole trees or logs at the orginal harvest site, thereby reducing transportation costs and the amount 6f wood not utilized.

After the logs have been converted to wood chips, they are "cooked" with chemicals under high temperature and pressure in a "digester," a kettlelike vat several stories high. Digesters are operated by skilled workers called *digester operators* (D.O.T. 532.782), who determine the amount of chemicals to be used and the cooking temperature and pressure. They also direct the loading of the digester with wood chips and chemicals. By checking an instrument panel, digester operators make certain that proper conditions are being maintained. When the pulp fibers are removed from the digester, they are washed to remove chemicals, partially cooked chips, and other impurities. These fibers, called pulp, resemble wet, brown cotton.

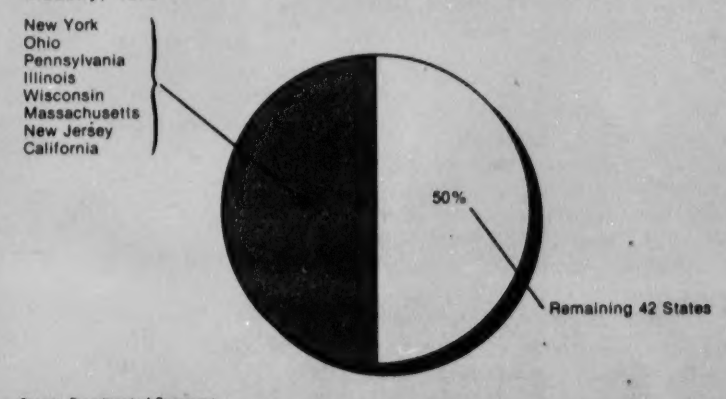
Many modern plants today are making greater use of continuous digesters (equipment that produces puip continuously rather than in separate batches). Continuous digesters make it practical to use sawdust in pulpmaking, and eliminate the manual starting and stopping of each batch of pulp.

To turn pulp into paper, the pulp is mixed thoroughly with water and further refined in machines operated by skilled workers called *beater engineers* (D.O.T. 530.782). The kind and amount of chemicals and dyes they use and the length of time they "beat" the solution determine the color and strength of the paper.

The pulp solution, now more than 99 percent water, is turned into paper or paperboard by machines that are among the largest in American industry. The machines are of two general types. One is the Fourdrinier machine, by far the most commonly used; the other is the cylinder machine used to make particular types of paper, such as building and container board. In the Fourdrinier, the

Half of all workers in the paper and allied products industry are employed in eight States

State distribution of employment in the paper and allied products industry, 1973



Source: Department of Commerce

pulp solution pours into a continuously moving and vibrating belt of fine wire screen. As the water drains, millions of pulp fibers adhere to one another, forming a thin wet sheet of paper. After passing through presses that squeeze out more water, the newly formed paper passes through the dryer section of the papermaking machine to evaporate remaining water.

The quality of the paper produced largely depends on the skills of *paper machine operators* (D.O.T. 539.782), who control the "wet-end" of the papermaking machine to form paper of specified thickness, width, and physical strength. They check control-panel instruments to make sure the flow of pulp and the speed of the machine are coordinated. Paper machine operators also determine whether the paper meets required specifications by interpreting laboratory tests or, in some instances, by visually checking or feeling the paper. They supervise the less skilled workers of the machine crew and, with their help, keep the paper moving smoothly through the machine.

Many modern papermills have papermaking machines that use computers and advanced instrumentation to help the operator control the quality of the paper. For example, beta-ray sensors measure the weight of the paper and electromagnetic sensors measure the thickness. Measurements from these devices are put into a computer that compares them to programmed specifications. The computer then adjusts the papermaking machine's operations to eliminate any differences. Computer process control also has brought about changes in job duties for some operator positions. Generally this has involved a reduction in manual manipulation of control devices and an increase in monitoring functions. For example, the computer sets production variables such as temperature, pressure, and flow rates whereas, before computer control, they were set by the machine operator.

Backtenders (D.O.T. 532.885), who are supervised by paper machine operators, control the pressure and temperature of machinery that dries and finishes the paper and gives it the correct thickness. Backtenders inspect the paper for imperfections and make sure that it is being wound tightly and uniformly into rolls. They also adjust the machinery that cuts the rolls into smaller rolls and, with the help of assistants, may weigh and wrap the rolls for shipment.

Papermills that produce a fine grade of paper for books, magazines, or stationary usually have finishing departments. Most workers in these departments are either semiskilled or unskilled. One semiskilled worker, the *supercalender operator* (D.O.T. 534.782), aided by several helpers and by mechanical handling equipment, places huge rolls of paper onto a machine that gives the paper a smooth and glossy finish. The supercalender operator also inspects the finished paper to make sure that specifications have been met. Another semiskilled worker, the *paper sorter and counter* (D.O.T. 649.687), inspects sheets of paper for tears, dirt spots, and wrinkles; counts them; and may fill customer orders.

In converting plants, machines operated by semiskilled or skilled workers convert paper and paperboard into envelopes, napkins, corrugated shipping containers, and other paper products. Occupations in converting plants differ widely, depending largely on the product being manufactured. An example of a semiskilled worker is the *envelope machine operator* (D.O.T. 641.885), who feeds and tends an automatic machine that makes envelopes from either rolls of paper or prepared envelope blanks. One of the few skilled workers in a converting plant is the *printer-slotter operator* (D.O.T. 651.782) who controls a machine that cuts and creases paperboard sheets and prints designs or lettering on them.

Converting plants employ thousands of workers to print designs and lettering on bags, labels, wallpaper, and other paper products. Among these are compositors, who set type, and press operators who prepare and operate printing presses.

Maintenance Jobs. The paper industry employs many skilled maintenance workers to care for its complex machinery and electrical equipment. *Millwrights* install and repair machinery. They also take apart and reassemble machines when they are moved about the plant. *Instrument repairers* install and service instruments that measure and control the flow of pulp, paper, water, steam, and chemical additives.

Other important maintenance employees include *electricians*, who repair wiring, motors, control panels, and switches; *maintenance machinists*, who make replacement parts for mechanical equipment; and *pipefitters*, who lay out, install, and repair pipes.

Stationary engineers are employed to operate and maintain powerplants, steam engines, boilers, air compressors, and turbines.

Professional and Technical Occupations. The complexity of pulp and paper manufacturing requires thousands of workers who have engineering, chemical, or other technical training. Approximately 16,000 scientists and engineers and 13,000 technicians were employed by the paper industry in 1976.

Many chemists are employed to control the quality of the product by supervising the testing of pulp and paper. In research laboratories, chemists study the influence of various chemicals on pulp and paper. In addition, some chemists and engineers are employed as sales representatives, supervisors of plant workers, or as administrators in positions which require technical knowledge.

Chemical and *mechanical engineers* transform new pulp and papermaking techniques into practical production methods. Some chemical engineers supervise the production process. *Electrical engineers* supervise the operation of power-generating and distributing equipment and instruments.

Packaging engineers design containers and packages and supervise their production. A few box manufacturers also employ artists who develop lettering, designs, and colors for containers.

Foresters manage large areas of timberland and assist in the wood-buying operations of pulp and paper companies. They map forest areas, plan and supervise the harvesting,

and seed or plant new trees to assure continuous production of timber.

Systems analysts and *computer programmers* are becoming increasingly important to this industry due to the greater use of computerized controls in the production process. They also analyze business and production problems and convert them to a form suitable for solution by computer.

Frequent tests are performed during the manufacture of pulp or paper to determine whether size, weight, strength, color, and other properties meet standards. Some testing is done by machine operators, but in many mills *testing technicians* are employed. These technicians, who have job titles such as laboratory technician, pulp tester, and chemical analyst, also assist engineers and chemists in research and development activities.

Administrative, Clerical and Related Occupations. The paper industry employs many administrative, clerical, and other office personnel. Executives plan and administer company policy. To work effectively, executives require information from a wide variety of personnel, including accountants, sales representatives, lawyers, and personnel in industrial relations, transportation, market research, and other activities. Bookkeepers, secretaries, shipping clerks, and other clerical workers keep records of personnel, payroll, inventories, sales, shipments, and plant maintenance.

Training, Other Qualifications, and Advancement

Paper and pulp companies generally hire and train inexperienced workers for production and maintenance occupations. Many companies prefer to hire high school graduates. Inexperienced workers usually start as laborers or helpers and advance along fairly well-defined paths to more skilled jobs.

Some large plants have formal apprenticeship programs for maintenance workers. Under these programs, which usually last 3 to 4 years, people are trained for jobs such as machinist, electrician, millwright, and pipefitter. Generally, an applicant is given a physical examination, mechanical aptitude tests, and similar qualifying tests. Apprenticeship includes both on-the-job training and classroom instruction related to the occupation. The machinist apprentice, for example, receives classroom instructions in mathematics, blueprint reading, and shop theory.

In newer mills, many experienced maintenance workers are being retrained to become multi or four-skilled craftworkers. The workers are given 18 months to become competent in each individual craft or a total of 4 1/2 years. For example, a pipefitter would learn the skills of a millwright, machinist, and an electrician.

A bachelor's degree is usually the minimum educational requirement for scientists, engineers, foresters, and other professional occupations. For research work, persons having advanced degrees are preferred. Many engineers and chemists (called *process engineers* and *paper chemists*) have specialized training in paper technology. Many companies have summer jobs for college students specializing in papermaking, and upon graduation frequently hire them on a permanent basis. Some associations, colleges and individual companies offer scholarships in pulp and papermaking technology.

Some companies have formal training programs for college graduates with engineering or scientific backgrounds. These employees may work for brief periods in various parts of the plant to gain a broad knowledge of pulp and paper manufacturing before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research, operation, or maintenance unit.

Generally, no specialized education is required for laboratory assistants, testing technicians, or other kinds of technicians. Some employers, however, prefer to hire technical institute or junior college graduates. Beginning technicians start in routine jobs and advance to positions of greater responsibility after they acquire experience and can work with minimum supervision.

Administrative positions usually are filled by people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. A knowledge of paper technology is helpful for administrators and sales occupations. This is true especially for sales representatives who give customers technical assistance. Most pulp and paper companies employ clerks, bookkeepers, stenographers, and typists who have had commercial courses in high school or business school.

For production workers, promotion generally is limited to more skilled jobs within a "work area," which may be a department, section, or an operation on one type of machine. For example, a person may start as a utility person and advance to backtender and finally to machine operator. These promotions may take years, depending on the availability of jobs. Experience gained within a work area usually is not transferable; unskilled or semiskilled workers who transfer to jobs outside their usual work area or to other plants usually must start in entry jobs.

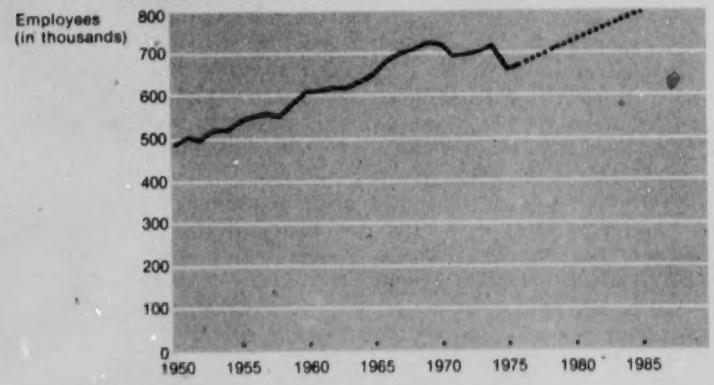
Many plant supervisors are former production workers. In some plants, qualified workers may be promoted directly to supervisory positions. In others, workers are given additional training before they are eligible for promotion. This training often is continued after the worker is promoted—through conferences, special plant training sessions, and courses at universities or trade schools. Most firms provide some financial assistance for employees who take courses outside the plant.

Employment Outlook

Employment in the paper and allied products industry is expected to increase more slowly than the average for all industries through the mid-1980's. Although a significant number of job openings are expected due to growth, most openings will stem from the need to replace workers who retire, die, or leave their jobs for other reasons. The number of job openings may fluctuate from year to year, however, because the demand for paper and paper products is sensitive to changes in economic conditions.

Employment in paper manufacturing is expected to continue growing over the long run

Wage and salary workers in paper and allied products manufacturing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Paper production is expected to increase over the long run as population and business activity grow and new uses for paper are developed. Employment will grow at a slower rate than production, however, because of the greater use of laborsaving machinery. Most of the employment growth will occur in plants that make finished products such as napkins, envelopes, boxes, and wrapping paper. These plants are not as suited for laborsaving machinery as plants that produce pulp and unfinished paper products.

Occupational groups within the industry are expected to grow at different rates. The number of engineers, scientists, technicians, and maintenance workers is expected to increase faster than other occupational groups in the industry. More scientific and technical personnel will be needed as research and development activities expand, and more maintenance workers will be required to service the more complex machinery. Employment of administrative and clerical workers also is expected to rise at a faster pace than total employment. On the other hand, the number of production workers may decline slightly as more laborsaving machinery is introduced. Nevertheless, replacement needs will create many job openings for production workers.

Earnings and Working Conditions

Production workers in the paper industry had average earnings of $5.43 an hour in 1976. In the same year, production workers in private industry, except farming, averaged $4.87 an hour.

The following tabulation, based on information from a number of union-management contracts in the paper industry, illustrates the approximate range of hourly wage rates for selected production and maintenance occupations in 1976. Local rates within these ranges depend on geographic location, type and size of mill, kinds of machines used, and other factors.

Most pulp and paper plants operate around the clock—three shifts a day, 7 days a week. Production workers can expect to work on evening or night shifts from time to time. Maintenance workers usually are employed on the regular day shift. Multi-craft maintenance mechanics generally earn about $1.50 an hour more than a single-craft mechanic.

	Hourly rate ranges
Production occupations:	
Paper machine operator	$5.34–10.41
Backtender	4.87– 9.91
Head stock preparer (beater engineer)	4.93– 7.01
Digester operator (cook)	5.07– 7.30
Supercalendar operator	5.18– 6.36
Barker operator, drum	4.69– 6.80
Chipper	4.40– 6.70
Maintenance occupations:	
Pipefitter	5.58– 7.76
Electrician	5.74– 7.76
Machinist	5.58– 7.76

In most plants the standard workweek is 40 hours; in a few it is 36 hours or less. Workers normally have year-round employment because paper production is not subject to seasonal variation.

Most pulp and papermaking jobs do not require strenuous physical effort. However, some employees work in hot, humid, and noisy areas. They also may be exposed to disagreeable odors from chemicals in the papermaking process. The rate of injury in this industry has been about the same as the rate for all manufacturing.

A majority of the production workers are members of trade unions. The largest union in the industry is the United Paperworkers International Union. Many osher workers in the Western States are represented by the Association of Western Pulp and Paper Workers. Many printing workers belong to the International Printing and Graphic Communications Union. Some maintenance and craft workers belong to various craft unions.

Sources of Additional Information

Further information about job opportunities in this industry is available from local offices of the State employment service and from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

Fibre Box Association, 224 S. Michigan Ave., Chicago, Ill. 60604.

A list of schools offering courses on paper technology is available from:

American Paper Institute, 260 Madison Ave., New York, N.Y. 10016.

For information on job opportunities for paper and paper products sales representatives, write to:

National Paper Trade Association, Inc., 420 Lexington Ave., New York, N.Y. 10017.

OCCUPATIONS IN THE PETROLEUM REFINING INDUSTRY

The petroleum refining industry forms the link between crude oil production and the distribution and consumption of petroleum products. Products refined from crude oil supply the fuels and lubricants used for all modes of transportation, for heat in homes, factories, and other structures, and for fuel for the generation of over one-third of our electric power. In addition, basic petroleum compounds are used to manufacture hundreds of everyday products such as synthetic rubber, fertilizers, and plastics.

In 1976 about 160,000 workers, who had a wide range of educational backgrounds and skills, were employed in the petroleum refining industry. This industry covers occupations and activities involved in refining oil. Occupations in petroleum and natural gas production and processing are discussed in a separate chapter elsewhere in the *Handbook*.

Nature and Location of the Industry

A modern refinery is a complicated plant made up of tanks and towers connected by a maze of pipes and valves. From the time crude oil enters the refinery to the shipment of finished products, the production flow is almost continuous. Operators use instruments including computers to measure and regulate the flow, volume, temperature, and pressure of liquids and gases going through the equipment. Manual handling of materials has been virtually eliminated.

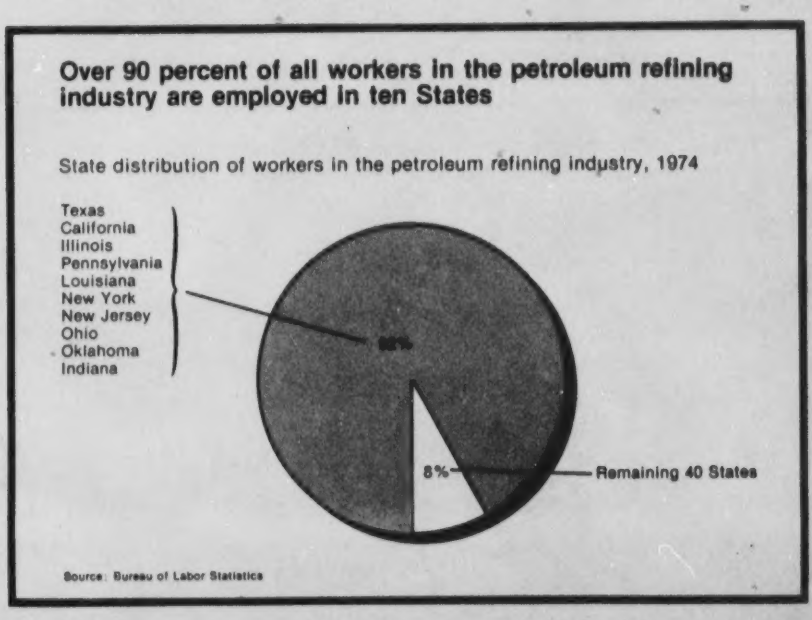
Petroleum refining consists of heating crude oil as it flows through a series of pipes in a furnace. The vapors from the heated oil pass into a tower where the various "fractions," or parts, of the oil are condensed. The heaviest parts (for example, heavy fuel oils and asphalt) are drawn off along the bottom of the tower where temperatures are highest; lighter parts (jet fuel and diesel fuel) are drawn off along the middle of the tower; and the lightest (gasoline and gases) are taken off at the top where temperatures are lowest. Since this process does not produce a sufficient quantity of some products, such as gasoline, further processing by more complicated methods combines or modifies products obtained through fractionating to increase the yield of some products. Treating units are used to remove water, sulfur compounds, and other impurities.

About 280 refineries were in operation in 1976. They ranged in size from plants with fewer than ten employees to those with several thousand. Although many States have refineries, about 85 percent of the workers were employed in 10 States: Texas, California, Pennsylvania, Illinois, Louisiana, Oklahoma, Ohio, New York, New Jersey, and Indiana. Refineries usually are located near oilfields, industrial centers, or deepwater ports where tankers can dock.

Occupations in the Industry

About 1 out of every 2 workers in a refinery is involved in the operation (as opposed to maintenance) of the plant. A key worker in converting crude oil into usable products is the *refinery operator* (D.O.T. 542.280), or chief operator, who is responsible for one or more processing units. The refinery operator, with help from assistant operators, makes adjustments for changes in temperature, pressure, and oil flow. In modern refineries, operators monitor instruments on panels that show the entire operation of all processing units in the refinery. They also patrol units to check their operating condition.

Other plantworkers may include *still pump operators* (D.O.T. 549.782), also known as pumpers, and their *helpers* (D.O.T. 549.884), who maintain and operate pumps that control all production throughout the refinery; and *treaters* (D.O.T. 549.782), who operate equipment to remove impurities from gasoline, oil, and other products. In automated plants, computers may do the work of pumpers and treaters. Operators



Operator observes refinery controls.

monitor the computers to spot potential problem areas, and may make routine checks of the refinery to make sure that valves are operating properly.

Many refineries employ large numbers of maintenance workers to repair, rebuild, replace, and clean equipment. In other plants, some maintenance work is contracted to companies outside the petroleum industry. Many maintenance workers are needed because high heat, pressure, and corrosion quickly wear out the complex refining equipment. Occupations involved in maintenance include skilled boilermakers, electricians, carpenters, instrument repairers, machinists, pipefitters, sheetmetal workers, and welders. There also are helpers and apprentices in these trades. Some skilled workers have a primary skill in one craft and also the ability to handle closely related crafts. For example, a pipefitter also may be a boilermaker and a welder. Maintenance workers who have such combined jobs are sometimes called refinery mechanics.

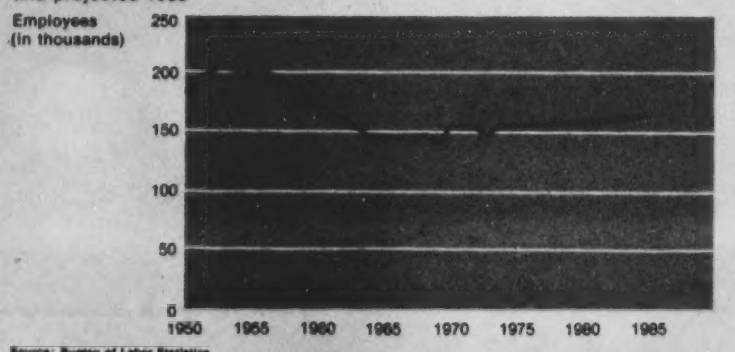
Plantworkers who do not operate, monitor, or maintain equipment do many other tasks. Some workers drive delivery trucks; some load and unload materials on trucks, trains, or ships; and others keep stock and tool inventory records. The industry also employs service workers such as guards and janitors.

About 12 percent of the workers in petroleum refining are scientists, engineers, and technicians. Among these are chemists, chemical engineers, mechanical engineers, environmental engineers, laboratory technicians, and drafters. Chemists and laboratory technicians control the quality of petroleum products by making tests and analyses to determine chemical and physical properties. Some chemists and chemical engineers develop and improve products and processes. Laboratory technicians assist chemists in research projects or do routine testing and sample taking. Some engineers design chemical processing equipment and plant layout, and others supervise refining processes. Environmental engineers and technicians supervise and improve treatment and disposal of refinery waste waters and gases. Drafters prepare plans and drawings needed in refinery construction and maintenance.

Refining companies employ many administrative, clerical, and other white-collar personnel. Administrative workers include managers, accountants, purchasing agents, lawyers, computer programmers, computer analysts, and personnel and training specialists. Typists, secretaries, bookkeepers, keypunch op-

Employment in petroleum refining is expected to show little change through the mid-1980's due to productivity improvements

Wage and salary workers in the petroleum refining industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

erators, and business machine operators assist administrative workers. (Detailed discussions of professional, technical, mechanical, and other occupations found not only in petroleum refining but also in other industries are presented elsewhere in the *Handbook*.)

Training, Other Qualifications, and Advancement

Employers prefer to hire applicants who are high school graduates. Aptitude testing and interviewing frequently are used in selecting applicants for plant jobs. Inexperienced plantworkers usually begin as aides in a labor pool; they may move materials, pack cartons, fill barrels, or do maintenance work. They may be transferred either to the operating department or the maintenance department when a vacancy occurs.

Workers newly assigned to an operating department learn to operate equipment under the guidance of experienced operators. Formal training courses frequently are given in plant operation.

A supervisor trains inexperienced workers in maintenance skills. Some refineries give classroom instruction related to particular work. After 3 or 4 years, a person may advance from helper to skilled craft worker in one of the maintenance crafts. Some large refineries train workers in several crafts. For example, a qualified instrument repairer may be given electrician or machinist training.

For scientists and engineers, a bachelor's degree in an appropriate field usually is the minimum educational requirement. Advanced degrees are preferred for research work.

For most laboratory assistant jobs, 2-year technical school training is required. Laboratory assistants begin in routine jobs and advance to positions of greater responsibility as they acquire experience and learn to work without close supervision. Inexperienced drafters begin as copyists or tracers and can advance to more skilled drafting jobs.

Administrative positions generally are filled by people who have college degrees in science and engineering, accounting, business, industrial relations, or other specialized fields. For positions as clerks, bookkeepers, secretaries, and typists, most refineries employ persons who have had commercial courses in high school or business school. For occupations associated with computers, educational requirements range from a high school level for keypunch operators to a college degree in the physical science field for analysts.

Employment Outlook

Employment in petroleum refining is expected to show little change through the mid-1980's. Refinery output is expected to increase to meet the Nation's growing demand for petroleum products, but automated, computerized plants, increased refining capacity, and improved refining techniques should make it possible for the industry to increase production without increasing employment significantly. Nevertheless, thousands of job openings will result from the need to replace workers who retire, die, or transfer to other occupations.

Most jobs will be for operators, maintenance workers, administrators, and technicians. More maintenance workers, such as electricians, pipefitters, and instrument repairers, will be needed to take care of the increasing amount of automated

Most refinery jobs require only moderate physical effort.

equipment and complex control instruments.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in manufacturing. In 1976 production workers in petroleum refining averaged $7.72 an hour, compared with an average of $4.83 an hour for production workers in manufacturing industries as a whole.

Because petroleum is refined around the clock, operators may be assigned to any one of the three shifts, or they may be rotated on various shifts. Some operators work weekends and get days off during the week. Employees usually receive additional pay for shift work. Most maintenance workers are on duty during the day.

Most refinery jobs require only moderate physical effort. A few workers, however, have to open and close heavy valves and climb stairs and ladders to considerable heights. Others may work in hot places or may be exposed to unpleasant odors.

Many refinery workers are union members and belong to the Oil, Chemical and Atomic Workers International Union. Some refinery workers are members of AFL-CIO craft unions or of various independent unions.

Sources of Additional Information

More information on job opportunities in the petroleum refining industry may be obtained from the personnel offices of individual oil companies. General information on jobs in the industry is available from:

National Petroleum Refiners Association, Suite 802, 1725 DeSales St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE PRINTING AND PUBLISHING INDUSTRY

Printing is both an art and one of our chief means of communication. In 1976, the printing and publishing industry employed almost 1.1 million workers. Government agencies and private firms that do their own printing, such as banks and insurance companies, also employed thousands of printing workers.

Nature and Location of the Industry

Included in the industry are the printing and publishing of newspapers, magazines, books, and advertising matter; the production of business forms, greeting cards, and gift wrappings; commercial or job printing; bookbinding; and typesetting, photoengraving, platemaking, and other printing services, primarily for printing establishments.

In 1976, the largest division in terms of employment was newspaper printing and publishing, with over 380,000 employees. Most daily and many weekly newspapers throughout the Nation do their own printing. Although some major newspapers have more than 2,000 employees, many have fewer than 20.

Commercial printing shops, the second largest division of the industry, employed about 359,000 workers. These shops produce a variety of materials, including advertising matter, business cards, calendars, catalogs, labels, maps, and pamphlets. They also print limited-run newspapers, books, and magazines. Many commercial shops have several hundred workers, but employment is concentrated in smaller shops.

Printing jobs are found throughout the country. Almost every town has at least one printing shop, frequently, a small newspaper plant that also may do other printing. However, about one-half of the Nation's printing employees are in five States—New York, Illinois, California, Pennsylvania, and Ohio. Within these States, most printing activities are in or near manufacturing, commercial, or financial areas such as New York, Chicago, Los Angeles, San Francisco-Oakland, Philadelphia and Cincinnati. Other leading centers of printing are Boston, Detroit, Minneapolis-St. Paul, Washington, D.C., St. Louis, and Dayton. Employment in book and magazine printing is highly concentrated in these areas. A much larger proportion of newspaper employment, however, is found outside these centers because of the great number of small local newspapers.

Printing Methods

Printing is a means of transferring ink impressions of words and pictures to paper, metal, or other materials. A plate of metal, rubber, or plastic is prepared so that part of it can be covered with ink. The ink is then transferred to a sheet of paper or other material that is pressed against the plate.

In letterpress printing, the letters and images are raised from the rest of the printing plate. Printing is achieved by covering the printing surface with ink and pressing it directly against paper, thus transferring the image onto the paper. In gravure printing, the image is etched into the surface of a cylinder. The whole surface is covered with ink and then wiped off; ink is left only in the sunken or etched areas. When paper is pressed against the surface, the ink is lifted out and appears on the paper. In lithography (offset printing), the printing plate surface is smooth, with both image and nonimage areas on the same level. Lithography is based on the principle that grease and wa-

The printing and publishing industry employed almost 1.1 million workers in 1976.

ter do not mix. The plate's image areas are coated with a substance to make the greasy printing ink stick to the plate and then moistened with water so that only the image areas take up the ink. The inked image is transferred from the plate to a rubber blanket and then to the paper.

Screen printing is a method in which inks or other materials such as paint and varnish are forced through a stencil mounted on a finely woven screen. The shape of the stencil openings determines the design to be printed. This process may be applied to a variety of surfaces such as paper, glass, metal, plastic, and textiles.

Printing Occupations

Production of printed materials requires workers in a wide variety of occupations. Printing craft workers represent a large segment of these employees. They usually specialize in one area of printing operations: Type composition, photography, platemaking, presswork, or binding. Their training generally is confined to only one of the basic printing methods—letterpress, lithography, or gravure. Some of the principal printing crafts are briefly described below. Detailed information on these crafts is presented in the section on printing occupations elsewhere in the *Handbook*.

The printing process begins in a composing room where manuscript copy is set in type, proofed, and checked for errors. Machine and handset type and other materials such as photoengravings are assembled there and prepared for the pressroom.

In 1976, almost 40 percent of all printing craft workers—152,000—were employed in composing room occupations. This group includes *compositors* (D.O.T. 973.381) who set type by hand or machine; *typesetter perforator operators* (D.O.T. 208.588) who punch tapes used to operate some typesetting machines; *make-up arrangers* (D.O.T. 973.381) who assemble type in shallow trays called "galleys" and make trial copy of this type; and *proofreaders* (D.O.T. 209.688) who check the trial copy with the original copy for errors.

Electrotypers and stereotypers (D.O.T. 974.381 and 975.782) make duplicate pressplates of metal, rubber, and plastic for letterpress printing. These plates are made from the metal type forms prepared in the composing room. Electrotypes are used mainly in book and magazine work. Stereotypes, which are less durable, are used chiefly in newspaper work.

Photoengravers (D.O.T. 971.381) make metal printing plates of illustrations and other copy that cannot be set up in type. The printing surfaces on these plates stand out in relief above the nonprinting spaces, as do the letters and the accompanying type. Similarly, *gravure photoengravers* (D.O.T. 971.381), a specialized type of photoengravers, make gravure cylinders in which the image is etched below the surface for use in reproducing pictures and type.

The actual printing operation is performed in the pressroom. *Printing press operators* (D.O.T. 651.782, .885 and .886) prepare type forms and pressplates for final printing and tend the presses while they are in operation. Small commercial shops generally have small and relatively simple presses that often are fed paper by hand. At the other extreme are the enormous presses used by the larger newspaper, magazine, and book printing plants. They automatically print the paper and cut, assemble, and fold the pages. These machines are operated by crews of press operators assisted by less skilled workers.

Lithography (offset printing) has grown to be the most widely used method of printing. Practically all items printed by other processes also can be produced by lithography. It is a process of photographing the matter to be printed, making a printing plate from the photograph, and pressing the inked plate against a rubber blanket which in turn presses it onto the paper. Several operations are involved in lithography, and each is performed by a specialized group of workers. The main group of lithographic workers are *camera operators* (D.O.T. 972.382), *artists and letterers* (D.O.T. 971.281), *strippers* (D.O.T. 971.381), *platemakers* (D.O.T. 972.381), and *press operators* (D.O.T. 651.885).

Because of the increasingly complex and highly mechanized printing equipment in use today, technically trained people are needed in all areas of printing management and production. For example, an increasing number of *production technicians* (D.O.T. 019.281) are employed to see that the standards for each printing job are met.

Many printed items, such as books, magazines, pamphlets, and calendars, must be folded, sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled bookbinders. In many binderies, however, a large portion of the work is done by less skilled bindery workers.

Besides printing craft workers, the industry employs people in a variety of other occupations. Many mailroom workers are employed in newspapers and magazine plants to address, bundle, and tie the printed matter for distribution. Modern mailroom processes are mechanized to a considerable extent. Mailers operate addressing, stamping, stacking, bundling, and tying machines. Many large printing firms employ mechanics and machinists to repair and adjust typesetting machines, printing presses, and other equipment.

Printing firms employ a great many people as executives, sales representatives, accountants, engineers, computer programers, stenographers, clerks, and laborers. Newspapers and other publishers employ a considerable number of reporters, editors, and photographers. These occupations are discussed elsewhere in the *Handbook*.

Training and Other Qualifications

Most printing craft workers (union or nonunion) learn their trades through established apprenticeship programs. A substantial number of people, however, learn these trades by working as helpers or through a combination of work experience and schooling.

Most printing unions, in conjunction with management, have established guidelines for apprenticeship

programs for the various printing crafts. Many nonunion printing firms have established apprenticeship programs with the help of local printing associations and the employer organization Printing Industries of America. Apprentices often are chosen from among people already employed in various unskilled jobs in printing plants.

Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and shop or area practices. The apprenticeship programs cover all phases of a particular trade and generally include classroom or correspondence study in related technical subjects, as well as on-the-job training. Apprenticeship applicants generally must be at least 18 years of age and pass an aptitude test and a physical examination. Applicants who qualify may be put on a waiting list if there are no immediate apprenticeship job openings.

Most employers prefer applicants to have a high school education or its equivalent. A thorough knowledge of spelling, punctuation, the fundamentals of grammar, and basic mathematics is essential in many of the printing trades. A knowledge of the basic principles of chemistry, electronics, and physics is becoming increasingly important because of the growing use of photomechanical and electronic processes in printing.

Most printing crafts require people with good eyesight, about average physical strength, and a high degree of manual dexterity. Alertness, patience, and the ability to work with others also are necessary. The ability to distinguish colors is important in areas of printing where color is used. An artistic sense also is an asset since the finished product should be pleasing in balance and design.

About 4,000 schools—high schools, vocational schools, technical institutes, and colleges—offer courses in printing technology. These courses may help a person to be selected for apprenticeships or other job openings in the printing and publishing industry.

Administrative jobs usually are filled by upgrading experienced people. Many owners and production managers of printing firms have come from the ranks of printing craft workers. In recent years, however, more firms are filling administrative positions with people who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized business fields. Most firms hire clerks, bookkeepers, stenographers, and typists who have completed commercial courses in high school or business school.

Some computer programmers in the printing industry have technical school training; others learn their skills on the job. Also, many compositors and typesetters are being taught computer programming skills, and the International Typographic Union has established a training center for this purpose.

Employment Outlook

Employment in the printing and publishing industry is expected to grow more slowly than the average for all industries through the mid-1980's. Most job openings will occur from the need to replace experienced workers who retire, die, or transfer to other industries.

The volume of printed materials is expected to increase rapidly because of population growth, the increasingly high literacy level of the population, and the trend to greater use of printed materials for information, packaging, and various industrial and commercial purposes. Employment will grow at a slower rate than the volume of printing, however, because of laborsaving technological changes in printing methods.

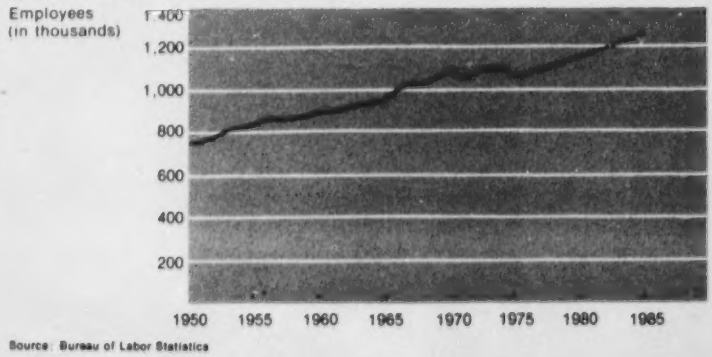
Occupational groups in the industry are expected to increase at different rates. Employment of technical, maintenance, and clerical workers will increase at a faster pace than total employment. Employment growth will vary among the printing crafts. The number of lithographic craft workers, for example, is expected to increase because of the growing use of lithography. On the other hand, since lithography does not require photoengraving, employment of photoengravers is expected to decline. The trend to computerization of typesetting operations will reduce the need for some machine operators in composing rooms while creating a demand for more computer typesetters. More mechanics will be hired to maintain the industry's increasingly complex machinery.

Earnings and Working Conditions

Earnings of production workers in the printing and publishing industry are among the highest in manufacturing. In 1976, they averaged $5.67 an

Employment in the printing and publishing industry has grown steadily, responding only slightly to economic downturns

Wage and salary workers in printing and publishing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

	Estimated average minimum hourly rate, 1976	
	Newspapers	*Book and job shops*
Bookbinders	—	$7.47
Compositors:		
Hand	$7.91	8.38
Machine operators	8.18	8.20
Electrotypers	—	7.23
Photoengravers	8.47	8.90
Press operators	7.65	—
Press (cylinder) operators	—	7.72
Press (platen) operators	—	6.63
Stereotypers	7.49	7.88

hour, while those in manufacturing industries as a whole averaged $5.19.

The accompaying tabulation shows average estimated union minimum hourly rates for selected printing occupations in 1976 based on a survey of 69 large cities. These are the minimum basic rates for daywork, and do not include overtime, other special payments, or bonuses.

Most printing craft workers who are covered by union contracts work fewer than 40 hours a week. Some contracts specify a standard workweek of less than 35 hours, but most fall within a 35 to 37-1/2 hour range. Time and a half generally is paid for overtime. Work on Sundays and holidays is paid for at time and one-half or double-time rates in most commercial printing firms. In newspaper plants, however, the workweek often includes Sundays. Time and one-half or double time is paid for these days only when they are not part of the employee's regular shift. Night-shift workers generally receive pay differentials above the standard day rates.

The starting wage rates of apprentices generally are from 40 to 50 percent of the basic rate for skilled workers in the shop. Wages are increased periodically, usually every 6 months, until the apprentice reaches the skilled rate.

The frequency of injuries in the printing industry is somewhat lower than the average for all manufacturing industries.

About 35 percent of all printing trades workers are members of unions. Among these unions are the Graphic Arts International Union, the International Printing and Graphic Communications Union, the International Typographical Union, and the International Mailers Union.

Sources of Additional Information

Details about employment opportunities and apprenticeships may be obtained from local employers, such as newspapers and printing shops, local offices of the unions mentioned above, or the local office of State employment services. Some State employment service offices screen applicants and give aptitude tests.

For general information on the industry, write to:

American Newspaper Publishers Association, 11600 Sunrise Valley Dr., Reston, Va. 20041.

American Photoplatemakers Association, 105 West Adams St., Suite 950, Chicago, Ill. 606043.

Graphic Arts Technical Foundation, 4615 Forbes Ave., Pittsburgh, Pa. 15213.

Gravure Technical Institute, 60 E. 42 St., New York, N.Y. 10020.

National Association of Printers and Lithographers, 570 Seventh Ave., New York, N.Y. 10018.

Printing Industries of America, Inc., 1730 N. Lynn St., Arlington, Va. 22209.

(See the section on printing occupations elsewhere in the *Handbook* for names of labor organizations and trade associations that can provide more information on specific printing trades.)

OCCUPATIONS IN THE TEXTILE MILL PRODUCTS INDUSTRY

Two hundred years ago no cloth was manufactured in the United States. Most had to be imported from England. Indeed, the textile industry was so important to England's prosperity that neither diagrams of the machinery nor the mechanics who operated it were allowed to leave Britain. In 1789, however, an English textile mechanic named Samuel Slater disguised himself as a farmer and sailed to the United States. He carried the details of the machinery where no official could find them: in his head. A few years later he opened a spinning mill in Pawtucket, R.I. Today, the spinning jennies Slater built stand silent, a show for tourists. But the industry that began in Pawtucket now includes 7,200 mills and factories, produces enough fabric each year to wrap around the earth 250 times, and provides jobs for about 1 million people.

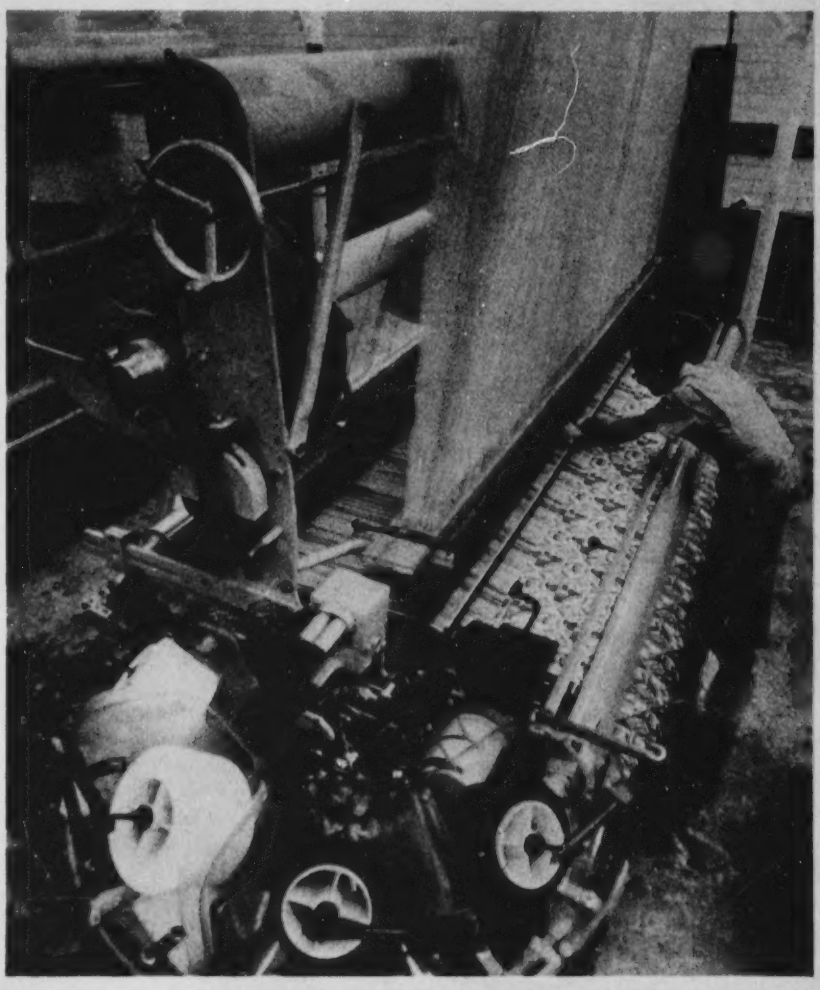
Nature and Location of The Industry

About one-half of all employees in the industry work in mills that weave or knit fabrics that will be made into clothing or household furnishings. Another one-third of the employees produce knit goods for use in making stockings and underwear, while most of the remainder work in mills that color or put patterns on the cloth, or that manufacture carpets and other products such as thread, lace, and cord for tires. About 9 out of 10 textile workers are employed in plants having 100 workers or more, although the majority of plants are small.

Textile plants are found in almost every State, but they are concentrated in a broad arc stretching from New England through the Southeastern United States into Texas. New England—where the industry was born—led the rest of the country in the number of textile mills until the early part of this century, when the Southeast became dominant. This shift occurred because the Southeast enjoyed several economic advantages, such as lower labor costs, cheaper steam and electric power, and greater accessibility to cotton. Today, the Northeast employs more people than any other region of the country in manufacturing narrow fabrics such as lace, ribbon, and fabric tape; in weaving and finishing wool; and in the production of miscellaneous textile goods. The South leads the rest of the country in every other sector of this industry. Three states—North Carolina, South Carolina, and Georgia—employ a little over half of all textile workers.

Occupations in the Industry

The raw materials of textile manufacturing must pass through many hands before becoming finished fabrics. As a result, most employees are directly involved in production, ei-



About one-half of all employees in the textile industry work in mills that weave or knit fabric.

ther working with their hands or operating machinery.

In the past, cotton was the basic raw material for the industry. Today, consumers demand fabrics that are durable and require minimal care while textile manufacturers continually seek cleaner raw materials. Accordingly, synthetic fibers, such as nylon or polyester, have replaced cotton as the leading raw material for the industry because they are easier for the consumer to care for and easier for the manufacturer to work with. Regardless of the raw material, however, all textiles are produced by spinning the fiber into yarn, weaving or knitting the yarn into fabric, and dyeing and finishing the fabric.

First the fibers must be prepared for spinning. In order to clean and align the fibers, they are combed and carded. Particularly short fibers are removed, and all fibers are drawn into a form that is strong enough to withstand the twisting process of spinning. Textile workers, called *opener tenders* (D.O.T. 680.885), *picker tenders* (D.O.T. 680.885), *card tenders* (D.O.T. 680.885), *drawing frame tenders* (D.O.T. 680.885), and *roving tenders* (D.O.T. 680.885), operate the machinery that prepares the fiber. They start, stop, and clean the machines. While patrolling the aisles between groups of machines, they also repair broken fiber ends and feed fiber into the machines.

When the fiber is ready for spinning, a spinning frame draws and twists it through rotating rollers and winds it on conical structures called bobbins. These machines, operated by frame spinners, turn the fiber into yarn. *Frame spinners* (D.O.T. 682.885) run rows of spinning frames, position bobbins of fibers, twist fiber ends, repair breaks in lengths of fiber, and clean the machines.

Spinning and weaving or spinning and knitting generally take place in the same plant. However, weaving and knitting operations usually are performed in different plants because these two methods of cloth manufacture and the machinery used to accomplish them are quite different. To prepare the yarn for weaving, *loom winder tenders* (D.O.T. 689.885), *spooler tenders* (D.O.T. 689.886), *warper tenders* (D.O.T. 681.885), *slasher tenders* (D.O.T. 582.782), and *warp tying machine tenders* (D.O.T. 681.885) position it on their respective machines, draw or thread the yarn into place, tie yarn ends, observe the machines to detect malfunctions, and remove the prepared yarn.

Fabric is produced on looms which interlace—weave—the yarn. There may be as many as 2,000 looms in the weaving room. *Weavers* (D.O.T 683.782) constitute about 10 percent of all textile machine operatives. They are skilled workers who monitor and operate as many as 200 looms at a time. They observe fabric being woven to detect and remove defects. They also repair breaks in yarn, fix minor loom malfunctions, and call *loom fixers* (D.O.T. 683.280) to make major repairs. Loom fixers not only repair machines, but also adjust them and prepare them for operation. Each of these highly skilled operatives works with several weavers.

Although most textiles are woven, knitted cloth claims a larger share of the market each year. To knit yarn, a *knitting machine operator* (D.O.T. 685.885) places it on a machine which produces fabric by intermeshing yarn loops. Knitting machine operators tend several machines at a time. They start the machines, feed in the yarn, observe the knitting process to detect malfunctions, tie broken yarn ends, and notify *knitting machine fixers* (D.O.T. 689.280) if they break down. Knitting machine fixers and loom fixers do similar work, but on different machines.

The most highly skilled workers in a knitting mill are *knitter-machine mechanics* (D.O.T. 685.380). They arrange metal pattern plates in the form of chains and place the chains in the knitting machines. The chains control the operation of the machines. Thus, these mechanics provide the means by which textile designs become knitted fabrics.

Once the yarn has been woven or knitted, the resulting fabric is ready to be dyed and finished either by textile mills that also weave or knit the fabric, or by independent businesses. *Dyers* (D.O.T. 582.138) develop dye formulas that are used to create a desired color. They also supervise the dyeing. *Dye weighers* (D.O.T. 550.884) mix the dyes and chemicals used in dyeing. *Dye range operators* (D.O.T. 582.782) run the machines that dye and dry the cloth.

Manufacturers print textiles in thousands of different colors and designs in order to appeal to a variety of consumer preferences. Printing may be done in several ways. One of the newest methods is rotary screen printing, a system in which a porous cylinder (screen) holds the print design. Dye in the cylinder is forced through the screen as the cylinder rolls over the cloth, leaving the print.

However, before the fabric can receive a print, the design must be created, and *colorists* (D.O.T. 022.181) must develop the colors for printing. *Screen printing artists* (D.O.T. 970.381) then use these colors to make color separations of designs on transparent paper. For each color, *screen makers* (D.O.T. 971.381) prepare a screen, treating it with emulsion and exposing it photographically to the appropriate transparency. *Screen printers* (D.O.T. 652.782) mount the screens on the rotary screen printing machines, fill the machines with dyes, and tend them as they print.

In addition to dyeing and printing, finishing often involves treating the fabric to prevent excessive shrinkage, strengthening it, or providing it with a silky luster. Each step offers job opportunities for textile machine operatives and general maintenance workers. People in several other occupations are important to the industry, although they are not directly involved in production. Among these are *textile designers* (D.O.T. 142.081), *textile engineers* (D.O.T. 183.118), and *textile technicians* (D.O.T. 689.384). These occupations usually require special talents and 2 to 4 years of education after high schoool.

Textile designers create the patterns, or designs, that are woven or knitted into fabrics or printed on them. Most designers work in New York City, where the designing and styling departments of most textile companies are located.

Textile engineers usually hold supervisory or managerial positions.

They may be plant managers who supervise entire plants, or plant engineers, responsible for the heating, air conditioning, electrical, materials handling, or other systems in textile establishments.

Textile technicians translate fiber properties into useful end products. They may work in research, developing new fiber processing techniques; in quality control and production, measuring major characteristics of raw textiles; or in customer sales and service, selling directly to customers or serving them. Many technicians work in the dyeing and finishing areas of textile plants.

In addition to occupations that are unique to the manufacture of textiles, many others are found in this industry. There are managers such as plant and department managers in all areas of the textile industry. Personnel specialists hire employees, and make sure that pay and benefits are received. There are jobs for bookkeepers, accountants, and computer programmers. The industry employs a wide assortment of clerical workers as well, including secretaries, computer console operators, and shipping and receiving clerks. There also are jobs for janitors, guards, and food service workers. Mechanics and repairers, besides those already mentioned, keep machinery and equipment operating properly. Laborers, such as freight and material handlers, often using mechanical devices, lift and move heavy loads to various textile machines.

Training, Other Qualifications and Advancement

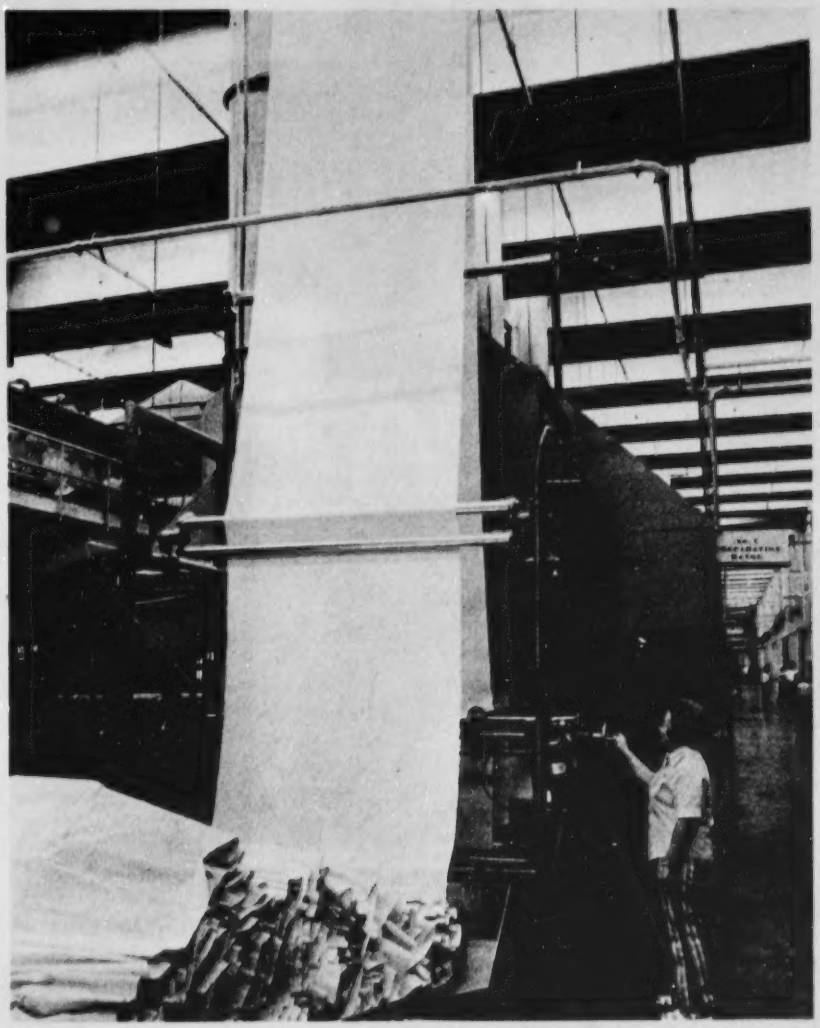
Most occupations in the textile industry are machine operative jobs that can be learned on the job. Other occupations require additional training and special skills. A small share of jobs is held by workers trained in professional fields.

Training for most production jobs is provided on the job and lasts from a few weeks to a few months, depending on the complexity of the work. Methods of instruction vary, but usually an employee starts out by assisting an experienced worker. Some mills set aside a section of the plant where full-time instructors—often former machine operators—show new workers how to operate the machines. Persons from outside the textile plant sometimes provide instruction. For example, manufacturers might explain the operation of new equipment or State educational coordinators might organize and conduct training programs at the request of the company.

Good coordination, good eyesight, and manual dexterity are important requirements for production jobs in this highly mechanized industry. Although most textile employers prefer that production workers have a high school education, they often do not require it.

Only a small percentage of workers in this industry are trained through apprenticeship programs. However, there are such programs, ranging in length from 2 to 4 years, for dyers, weavers, loom fixers, electricians, and some other occupations. Persons interested in these programs should contact a textile employer or a local State employment service office.

Some production workers become instructors and train new employees. Others may advance to supervisory or management positions after having shown interest and ability at jobs of increasing responsibility. Most textile companies have training pro-



Most occupations in the textile industry are machine operative jobs that can be learned on the job.

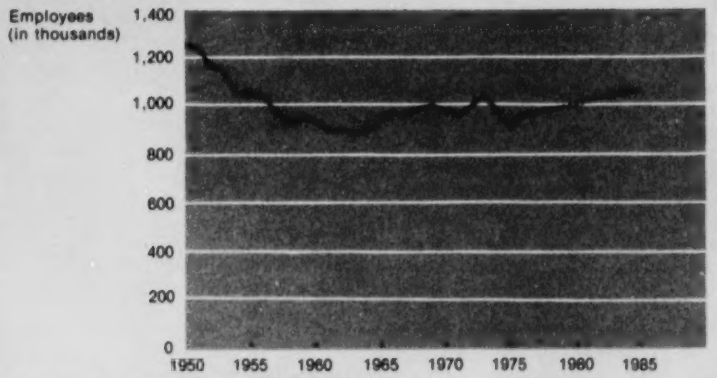
grams to help an employee advance in skilled occupations; many pay all or part of the tuition for courses taken at private and public schools and colleges which the company determines would help the employee advance to positions of increased responsibility.

Textile designers and textile technicians need training at a technical institute, a technically oriented junior college, or a 4-year textile college. Talent, demonstrated in high school courses in art, drawing, and design, indicates a potential for success in the textile design field, although competition for jobs in these fields may be stiff. Textile designers need a vivid and fertile imagination, a feeling for color and design, sensitivity to consumers' desires, and the ability to visualize the effect of designs on cloth. Qualifications of a good textile technician include manual dexterity, the ability to communicate well, both orally and in writing, and patience with details. High school courses in algebra, geometry, chemistry, physics, and English are good preparation for textile technician jobs. Advancement for a textile technician often means promotion to a supervisory position such as department head or blue-collar worker supervisor in the company's production division.

Graduates of 4-year colleges hold the majority of management jobs in textile companies. Textile manufacturers are particularly interested in those with degrees in engineering and business-related subjects although the industry employs graduates with degrees in various fields, including liberal arts and business. Also, graduates of textile colleges or those who majored in textile curriculums often have a head start on advancement to management positions. Textile curriculums include studies in various phases of the manufacturing process or in the operation of the industry, such as textile engineering, textile chemistry, or textile management. Ten colleges in the United States offer 4-year undergraduate degrees in textiles; most of these institutions are located in the northeastern and southeastern parts of the country. High school courses in mathematics and the physical sciences are good preparation for pursuing degrees in textile engineering or chemistry, while courses in business and economics provide a good basis for pursuing a degree in textile management.

Employment in textile manufacturing, which declined in the 1950's, is expected to continue at recent levels

Wage and salary workers in textile mill products manufacturing, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Many college graduates begin careers in the textile industry as management trainees. Training programs may extend over several months and are usually designed to expose a new employee to all facets of the company—its organization, policies, manufacturing processes, and merchandising techniques. Programs include classroom instruction, plant site visits, and management internships in various departments of a company. Having completed their training, many of them move into manufacturing supervisory jobs, from which they often advance to positions of increasing responsibility.

Upper level management positions in textile companies include plant engineer and plant manager. College graduates with degrees in engineering eventually may become engineers for an entire plant. Those who become plant managers frequently have degrees in textile engineering or textile management, as well as the demonstrated ability to lead and motivate people.

Employment Outlook

Textile industry employment growth is expected to be slower than the average for all industries through the mid-1980's. Many more job openings will result from persons leaving the industry because of death, retirement, or for other reasons than from employment growth. The demand for textile employees, particularly skilled and semiskilled workers, will be greatest in the Southeast.

Textile output is expected to expand over the next decade in response to demand from the apparel and home furnishings industries which are spurred by growth in population and incomes. An anticipated increase in the variety of textile products also should contribute to growth in output. In addition, although competition from imports has diminished the demand for domestic products of some sectors of this industry, recent negotiation of a new international trade agreement limiting textile imports probably will weaken this competition.

Textile employment is expected to grow more slowly than the industry's output, however, since laborsaving machinery and the use of synthetic fibers increase worker productivity. Numerous improvements in machines and production processes will continue to reduce demand for workers in yarn manufacture and weaving. Electronic instrumentation, which reduces the need for maintenance

Table 1. Average Hourly Earnings of Production Workers in Weaving Mills and Yarn and Thread Mills Industries, Selected Occupations and Areas, 1975

Weaving mills and yarn and thread mills	Estimated Average Hourly Earnings		
	New England	Middle Atlantic	Southeast
All production workers	$3.17	$3.33	$3.07
Card tenders	3.01	[1]	2.85
Frame spinners	3.08	[1]	2.93
Slasher tenders	3.53	3.53	3.35
Warper tenders	3.08	3.70	3.02
Loom fixers	3.82	4.68	4.05
Weavers	3.62	4.07	3.55

[1] Not available.

workers, is expected to become increasingly important. Also, the coming decade will see the greater use of computers as a management tool and as a means of controlling parts of the production process.

Although the adoption of technologically advanced machinery will diminish the need for semiskilled and unskilled workers, the demand for skilled workers and professional and managerial personnel will increase. Skilled production workers, such as knitter machine mechanics and dyers, will become more essential as textile machinery increases in complexity. New technologies, such as computer processing and electronic instrumentation, will require more textile technicians and computer specialists. The industry's demand for college graduates in textile engineering and textile management also will grow. Federal Government safety and health regulations as well as scientific research and development will continue to stimulate demand for chemists, and mechanical, electrical, and industrial engineers.

Earnings and Working Conditions

Average hourly earnings of production workers in the textile industry in 1976 were below those of production workers in all manufacturing industries—$3.67 versus $5.19.

In 1976, production workers' average wages ranged from $3.44 an hour in yarn and thread mills to $3.97 an hour in textile finishing plants. There also is some variation in wages by geographic area. A 1975 Bureau of Labor Statistics survey of weaving mills and yarn and thread mills indicated average earnings of production workers in the Southeast were $3.07 an hour; in New England $3.17 an hour; and in the Middle Atlantic region, $3.33 an hour. Table 1 gives estimated average hourly earnings in 1975 for selected occupations and regions in one segment of the industry. According to limited information, starting salaries for professional workers in the textile industry ranged from $10,000 to $12,000 a year in 1976.

Although some textile production workers are paid according to incentive plans—i.e. according to how much they produce—about 3 out of every 4 are paid time rates. Workers usually paid under incentive wage plans include drawing-frame tenders, spooler tenders, and weavers.

Although the average workweek for textile production workers is close to 40 hours, about the same for production workers in all manufacturing industries, many textile employees, particularly in the Southeast, work 46 to 48 hours a week. Most textile mills operate 24 hours a day, each day divided into three shifts. A shift differential is usually paid to those who work the 3d, or late, shift.

There are few seasonal influences on textile plant operation. When there is a lack of work due to recession or for some other reason, the textile industry usually chooses to reduce operations by 1 or 2 days a week rather than close down the plants altogether.

Although most textile employees work with or near machinery, the accident rate for the industry is slightly lower than the average for all manufacturing industries. Some workers, however, are subjected to noise from machinery. Most employees work in newer buildings where temperature and humidity controls are common, although lint-laden air and poor lighting are problems in some older plants.

Benefits for textile employees in both unionized and nonunionized plants usually include paid holidays and vacations, pensions or retirement plans, hospitalization insurance, and sick pay. Additional benefits provided by labor-management agreements in unionized plants include provisions for arbitration of grievances and protection of workers from the unfavorable effects of technological change such as layoffs and undesirable changes in work assignments.

About one-fifth of all textile workers are members of labor unions, whereas about half of all manufacturing workers are union members. The major textile unions are the Amalgamated Clothing and Textile Workers Union (ACTWU) and the United Textile Workers of America (UTWA).

Sources of Additional Information

Information on vocational education for occupations in the textile industry is available from the Division of Vocational Education of the Department of Education in each State.

For information on educational requirements and occupational descriptions, write to:

American Textile Manufacturers Institute, Wachovia Center, 400 S. Tryon St., Charlotte, North Carolina 28285.

United Textile Workers of America, 420 Common St., Lawrence, Mass. 01840.

For information regarding specific jobs in your area, contact the local office of the State employment service.

TRANSPORTATION, COMMUNICATIONS, AND PUBLIC UTILITIES

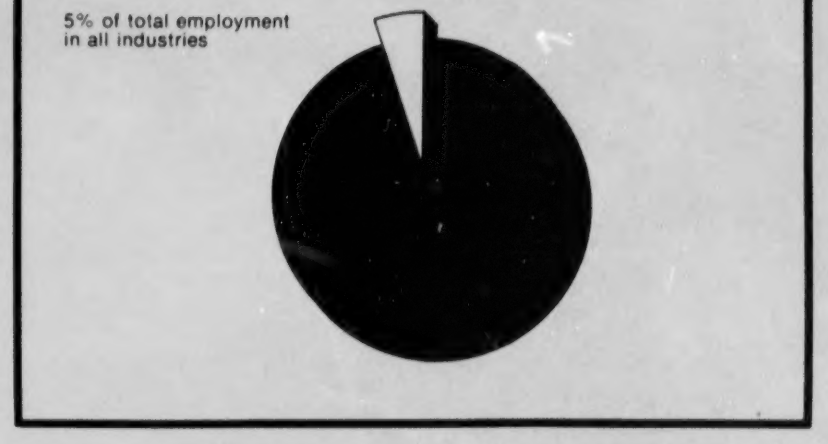
Transportation, communications and public utility firms are commonly grouped together because they provide a public service and are owned or regulated by government or other public agencies. The purpose of this regulation varies from industry to industry, but in general the goals have been to ensure fair prices and to see that the public interest is served.

In 1976, almost 5.7 million people worked in this group of industries, almost one million of them in Federal, State, and local governments owning or regulating part of the industry. The two largest industries were communications, which employed 1.2 million workers, and motor freight transportation and warehousing (including local and long-distance trucking), which employed over 1 million workers. Close behind were electric, gas, and sanitary services with 750,000 workers, and railroads with 525,000.

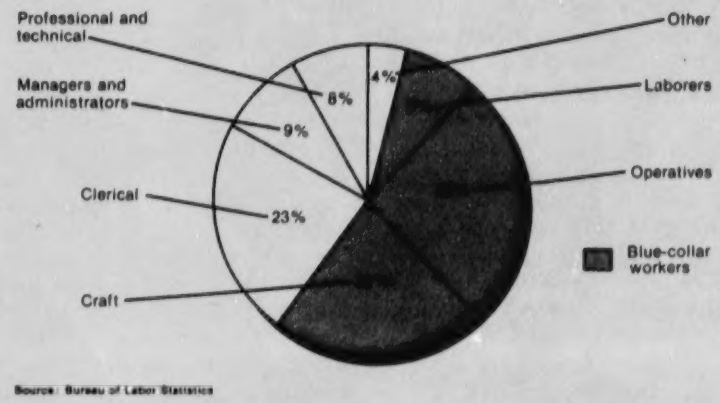
As shown in the accompanying tabulation, blue-collar workers (craft workers, operatives, and laborers) accounted for three-fifths of the total employment in these industries in 1976. The remaining two-fifths were white-collar workers (professional, managerial, clerical, and sales). However, the occupational pattern differed among the various industries.

In the transportation industries, blue-collar operatives constitute the largest group of workers, almost three times as large as the next largest occupational group. Among the operatives are the thousands of bus and taxi drivers who provide public transportation. But over half of the total number of drivers are local and long-distance truck drivers who move goods throughout the country. Other operative workers include rail-

Transportation, communications, and public utilities, 1976



Three out of every five employees in transportation, communications, and public utilities in 1976 were blue-collar workers



Source: Bureau of Labor Statistics

road brake operators and sailors. Many craft workers also are needed in the transportation industries, such as the railroad shop workers who repair locomotives, and airplane mechanics. Also needed are numerous clerical employees, such as reservation and ticket clerks, yard clerks, and secretaries.

The communications industries employ many clerical workers to help provide vital public services such as the telephone, newspapers, and television. Secretaries, bookkeepers, stenographers, and payroll clerks keep records and prepare statistical reports. These workers, for example, ensure that customers are billed correctly for telephone and telegraph services. Also included are switchboard operators and messengers. The communications industries also employ entertainers, writers, interpreters, and other professionals. Many craft workers are employed to install, maintain, and repair the equipment used in the telephone industry and in radio and television studios.

Electric, gas, and water utilities, and sanitary services need a large number of craft workers to provide prompt and efficient service to consumers. In the electric power industry, for example, these employees install powerlines and run cables underground. They also repair all equipment, including the machinery in the powerplants and the meters in customers' homes. The need to record the use of these utilities and to bill customers promptly accounts for the large number of clerical employees that also are found in this industry group.

Employment in the transportation, communications, and public utility industries is expected to increase about as fast as the average for all industries through the mid-1980's. In addition to openings resulting from growth, many thousands of jobs will be available each year because of the need to replace workers who die, retire, or transfer to other industries.

Employment growth in the transportation industries will vary. Rising population and business expansion will stimulate growth in interurban transit at a faster than average rate. Average growth is expected in air transportation, trucking, and some local passenger transportation (subways and local buses). On the other hand, taxicab service employment is expected to remain about the same. The long-run decline in railroad employment is expected to continue, but at a decreasing rate.

Employment in communications is expected to grow at about the same rate as the average for all industries through the mid-1980's Although demand for the services provided by the communications industries will increase rapidly, advances in technology are expected to limit employment growth in some occupations, particularly in telephone communications. Computers and other electronic equipment are expected to be applied increasingly to work previously done by wage earners. For example, when long-distance phone calls are dialed directly, the length of the call and billing information can be recorded automatically. This reduces the need for telephone operators.

Employment in electric and gas utilities also will be affected strongly by advancing technology, so that while the demand for these utilities will increase greatly, the number of workers will grow at about the average rate. Most of the employment increase will be for scientific, engineering, and other technical workers as research accelerates in the development of more efficient ways of using energy.

The statements that follow cover major industries in the transportation, communications, and public utility fields. More detailed information about particular occupations in these fields appears elsewhere in the *Handbook*.

CIVIL AVIATION

The rapid development of air transportation has increased the mobility of the population and has created many thousands of job opportunities in the civil aviation industry. In 1976 over 425,000 people were employed in a variety of interesting and responsible occupations in this industry.

Characteristics of the Industry

Many different organizations and activities are involved in civil aviation. The most familiar are airlines that provide transportation for passengers and cargo. Airlines account for almost four times as much intercity passenger travel as buses and railroads combined. Other commercial transportation is provided by air taxi companies that use small planes to provide passenger and cargo service, often to and from small airports not serviced by the airlines.

The civil aviation industry includes other kinds of flying activities. For example, many businesses transport executives in company planes. Some firms and individuals use their own planes for crop dusting, inspecting pipelines, and other activities. The government-licensed shops that repair and inspect smaller airplanes also are included in the industry.

The Federal Aviation Administration (FAA) and the Civil Aeronautics Board (CAB)—both part of the Federal Government—regulate the civil aviation industy. The FAA develops air safety regulations, coordinates flights, operates ground navigation equipment, and licenses some personnel, including pilots and aircraft mechanics. The CAB makes policy on airline rates and routes.

In 1976, about 303,000 employees worked for the airlines. Most of the remaining civil aviation employees worked for air taxi companies, for firms that use airplanes to transport executives, and for firms that rent, service, or repair aircraft. The rest worked for the Federal Government; in 1976, the FAA employed about 58,000 people, the CAB less than 1,000.

About half of all airline employees work at airports near New York, Miami, Los Angeles, San Francisco, Chicago, Atlanta, and Dallas, the cities where major airlines are based. Others work at airports scattered throughout the country. Most other civil aviation employees work at airports near large cities.

Civil Aviation Occupations

Over two-thirds of all civil aviation employees work in ground occupations. Many of these are mechanics and aircraft maintenance personnel who refuel, clean, inspect, and repair the planes between flights. Other large groups make reservations and sell tickets for the airline companies. Some are air traffic controllers and flight service specialists for the FAA. Flight service specialists assist pilots before the flight by suggesting routes and altitudes and providing them with information on their particular area, such as terrain and weather peculiarities. Other groundworkers include cargo and freight handlers, dispatchers, and clerical, administrative, and professional personnel.

Flight crewmembers make up the remaining one-third of civil aviation employment. They include the pilots who fly the planes and the flight

Over two-thirds of all civil aviation employees work in ground occupations.

Reservation agents use computer terminals to make reservations.

attendants who assist passengers. Detailed discussions of most of the principal occupations in civil aviation are presented elsewhere in the *Handbook* in the section on Air Transportation Occupations.

Training, Other Qualifications, and Advancement

Jobs are available to persons with a wide variety of training and backgrounds. Some jobs require previous training and may require certificates from the FAA. Others can be learned on the job.

Pilots must have a commercial pilot's license from the FAA when they begin work. Many also have an air transport license. They must have an instrument license to fly when the weather is bad. As a rule new airline pilots begin as flight engineers and must have a flight engineer's license.

Interested persons may obtain pilot training from military or civilian flying schools. Physical requirements are strict. With or without glasses, pilots must have 20/20 vision, good hearing, and no physical handicaps that prevent quick reactions. In addition, airlines generally require 2 years of college and prefer college graduates. Advancement for pilots usually is limited to better flying jobs.

Applicants for flight attendant jobs must be in excellent health, and those who have some college and have experience in dealing with the public are preferred. Applicants are trained for their jobs at company schools. Advancement opportunities are limited, although some attendants become customer service directors, instructors, or recruiting representatives.

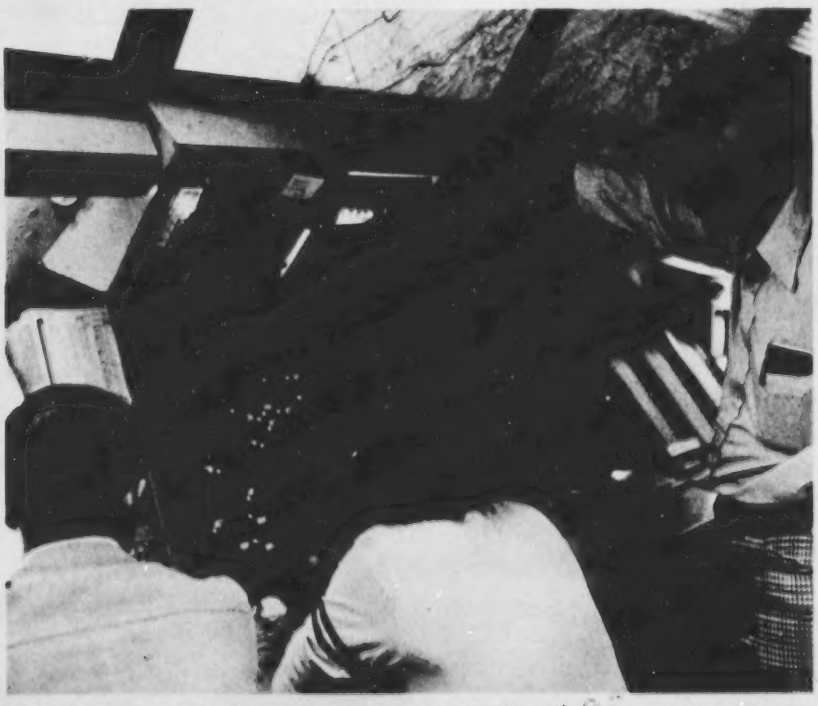
When hiring airplane mechanics, employers prefer graduates of airplane mechanic trade schools who are in good physical condition. Most mechanics remain in the maintenance field, but they may advance to head mechanics, inspectors, and in a few cases, to supervisory and executive positions. Some jobs require aircraft mechanics to be certified by the FAA.

New reservation, ticket, and passenger agents are trained by the company. A good speaking voice and a pleasant personality are necessary, because these workers deal directly with the public. A high school education is required.

Air traffic controllers work for the FAA and are selected through the competitive Federal Civil Service System. Applicants must pass a rigid physical examination and a written test. The FAA trains new workers on the job and at the FAA Academy. All workers must be certified by FAA examiners before they can work as controllers. Controllers can advance to supervisory positions and to higher management jobs in air traffic control.

Completion of commercial courses in high school or business school is usually adequate for entry into general clerical occupations such as secretary or typist. However, additional on-the-job training is needed for specialized clerical occupations such as bookkeeper.

Administrative and sales positions usually are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad picture of air transportation operations before they are assigned to a particular department.



Controllers at an air traffic control center coordinating flights to prevent collisions.

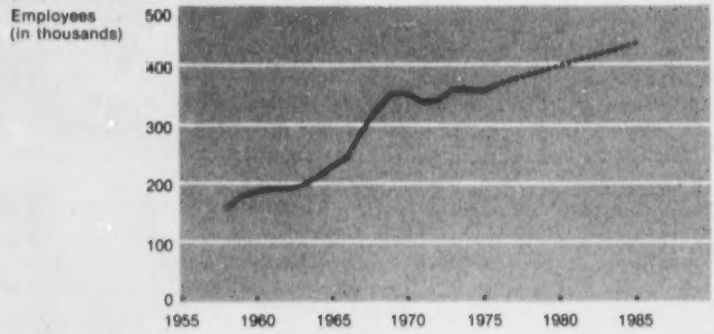
Employment Outlook

The total number of workers in civil aviation occupations is expected to increase about as fast as the average for all occupations through the mid-1980's. Besides the job openings that will be created by employment growth, many openings will arise as experienced workers retire, die, or transfer to other fields of work. Job opportunities may vary from year to year, however, because the demand for air travel fluctuates with ups and downs in the economy

Airline employment is expected to increase as passenger and cargo traffic grows in response to increases in population, income, and business activity. Employment in other civil aviation activities is expected to rise as more aircraft are purchased for business, agricultural, and recreational purposes.

Employment in civil aviation is expected to experience moderate long-term growth, following a rapid increase during the late 1960's

Wage and salary workers in transportation by air, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

Earnings and Working Conditions

Airline employees earned an average of $20,900 a year in 1976, over twice the average for all nonsupervisory workers in private industry, except farming. Among the major occupations, salaries ranged from $800 a month for new reservation agents to $6,500 a month for experienced airline captains. As an additional benefit, airline employees and their immediate families are entitled to reduced-fare transportation with their own and most other airlines.

Because airlines operate flights at all hours of the day and night, personnel in some occupations often have odd hours or work schedules. Flight and ground personnel may have to work at night, on weekends, or holidays. Flight personnel also may be away from home bases about one-third of the time or more. When they are away from home, the airlines provide hotel accommodations. Ground personnel usually work a 5-day, 40-hour week. They generally receive extra pay for overtime work or an equal amount of time off.

Sources of Additional Information

For information about job opportunities in a particular airline, write to the personnel manager of the company. Addresses of companies are available from:

Air Transport Association of America, 1709 New York Ave. NW., Washington, D.C. 20006.

For information about FAA-approved schools that offer training for airplane mechanics, pilots, or other technical occupations in aviation, write to:

Research and Inquiry Division, Office of Information Service AIS-230, Federal Aviation Administration, Washington, D.C. 20591.

OCCUPATIONS IN THE ELECTRIC POWER INDUSTRY

Electricity has become so much a part of our daily lives that most people take it for granted. But just imagine not being able to ride the elevator to your apartment and instead having to walk up all those flights of stairs. Or think about having no lights, television set, or radio in your home. Today, it would be difficult to get used to living without electricity.

Bringing electricity into our homes and places of work and recreation is not as simple as just turning on a switch. There are thousands of employees working in the electric power industry to make all this possible.

Nature and Location of the Industry

The delivery of electricity to users at the instant they need it is the unique feature of the electric power systems. Electricity cannot be stored efficiently but must be used as it is produced. Because a customer can begin or increase the use of electric power at any time by merely flicking a switch, an electric utility system must have sufficient capacity to meet peak consumer needs at any time.

An electric utility system includes powerplants that generate electric power, substations that increase or decrease the voltage of the power, and vast networks of transmission and distribution lines. Electric utilities range from large systems serving broad regional areas to small power companies serving individual communities. Most electric utilities are investor-owned (private) or owned by cooperatives; others are owned by cities, counties, and public utility districts, as well as by the Federal Government. While some utilities generate, transmit, and distribute only electricity, others distribute both electricity and gas. This chapter is concerned with employment relating only to the production and distribution of electric power.

Producing and distributing large quantities of electrical energy involves many processes and activities. The accompanying chart shows how electric energy is generated, and how it travels from the generating station to the users.

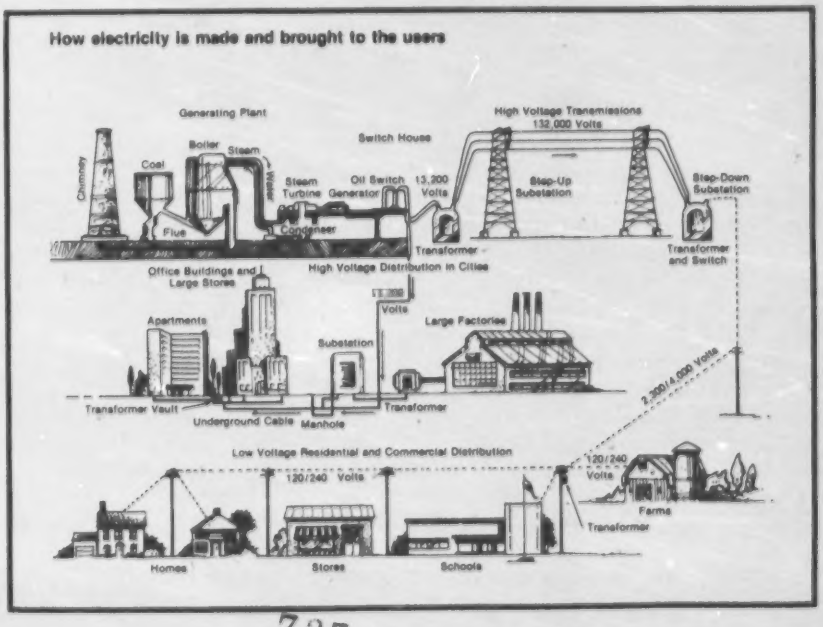
The first step in providing electrical energy occurs in a generating station or plant, where huge generators convert mechanical energy into electricity. Electricity is produced primarily in steam-powered generating plants that use coal, gas, oil, or nuclear energy for fuel. In addition, a considerable amount of electricity is produced in hydroelectric generating stations that use water power to operate the turbines. Still other generators, primarily for use in standby service or to provide electricity for special purposes, are powered by diesel engines or gas turbines.

After electricity is generated, it passes through a "switchyard," where the voltage is increased so that the electricity may travel long distances without excessive loss of power. Next the electricity passes onto transmission lines that carry it from the generating plant to substations, where the voltage is decreased and passed on to the distribution networks serving individual customers. Transmission lines tie together the generating stations of a single system and also the power facilities of several systems. In this way, power can be interchanged among several utility systems to meet varying demands.

In 1976, 544,000 people worked in the electric power industry. Most of them, 461,000, worked in investor-owned utilities and cooperatives and 80,400 worked in Federal and municipal government utilities. A few large manufacturing establishments, which produce electric power for their own use, also employ electric power workers.

Since electricity reaches almost every locality, jobs in this industry are found throughout the country. Although hydroelectric power projects have created jobs in relatively isolated areas, most utility jobs still are found in heavily populated urban areas.

How electricity is made and brought to the users



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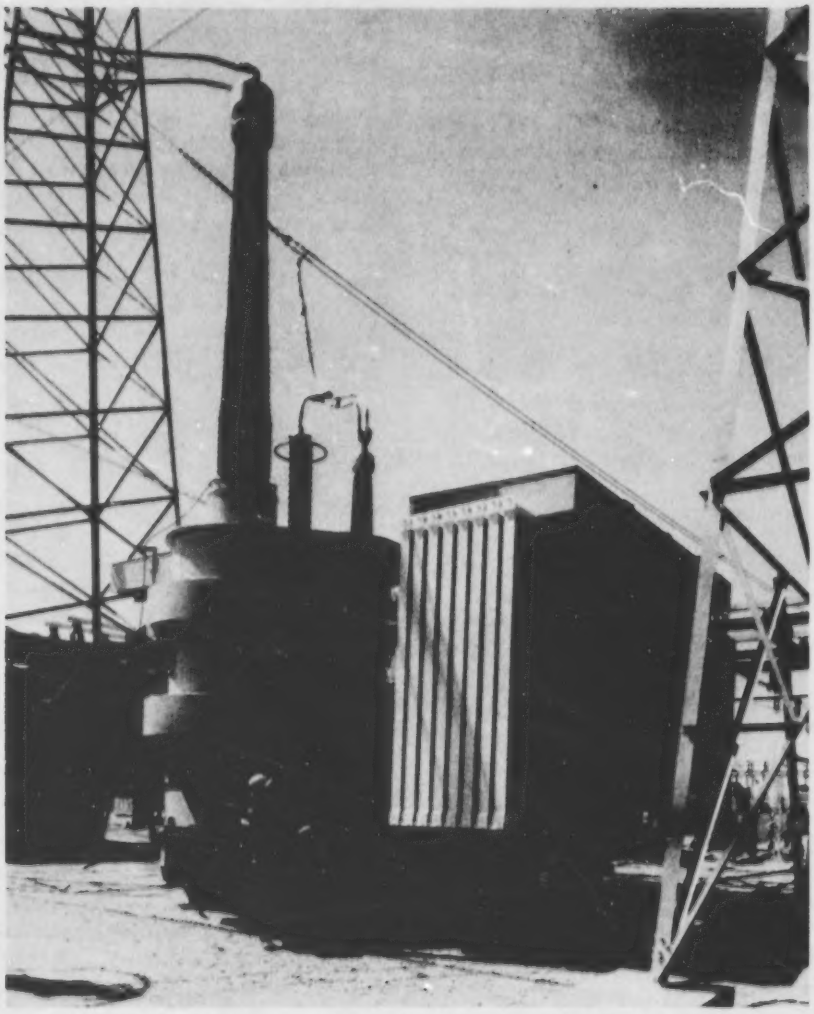

Jobs in the electric power industry are found throughout the country.

Electric Utility Occupations. Many different types of workers are required in the electric power industry. About 40 percent of the industry's employees work in occupations related to the generation, transmission, and distribution of electricity, and in customer service occupations. (These occupations are discussed in detail later in this chapter.) The industry also employs large numbers of workers in engineering, scientific, administrative, sales, clerical, and maintenance occupations. A brief discussion on these occupations is given below. Further information can be found in statements covering individual occupations elsewhere in the *Handbook*.

Engineering and Scientific Occupations. Engineers plan generating plant construction and additions, interconnections of complex power systems, and installations of new transmission and distribution systems and equipment. They supervise construction, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In planning modern power systems, engineers help select plantsites, types of fuel, and types of plants. Engineers also help industrial and commercial customers make the best use of electric power. For example, they may demonstrate how to modernize a chemical manufacturing plant or how to remodel a store or hotel, suggesting changes that would use electricity more effectively.

Administrative and Clerical Occupations. Because of the enormous amount of recordkeeping required, electric utilities employ many administrative and clerical personnel. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, accounting and auditing clerks, and cashiers are employed. These workers keep records of the services rendered by the company, make up bills for customers, and prepare a variety of statements and statistical reports. An increasing amount of this work in the larger offices now is being performed by computers. This generally results in more clerical work being done either by fewer or by the same number of employees. The use of this equipment also creates a need for programmers and computer operators. Administrative employees include accountants, personnel officers, purchasing agents, and lawyers.

Maintenance Occupations. A considerable number of workers test, maintain, and repair equipment. The duties of these skilled craft workers are similar to those of maintenance workers in other industries. It may be necessary to replace a switch or transformer, for example, or a weak section in a boiler may have to be repaired. Among the more important skilled workers are electricians, instrument repairers, industrial machinery repairers, machinists, pipefitters, welders, and boilermakers.

Employment Outlook

Employment in the electric power industry is expected to increase about as fast as the average for all industries through the mid-1980's. The greater use of electric power in industrial processes, growth of commercial centers such as shopping malls, and population growth all will contribute to an increased demand for electricity. However, due to the growing use of automatic controls, employment will not increase as fast as electric power production.

Trends in growth will differ from one occupation to another in the industry. The need for scientific, en-

gineering, and technical employees is expected to increase sharply as construction of power generating plants increases and as research into developing more efficient energy usage to combat shortages and higher prices of fossil fuels becomes necessary. Much of this increase in employment will be in the development and construction of new nuclear power facilities.

In many other occupations in this industry, only slight increases in employment are expected. Larger, more efficient powerplants will limit growth of employment of powerplant employees. The increased use of electronic data processing equipment for billing and recordkeeping will restrict growth in some clerical jobs. In occupations that will experience little or no growth, most job openings will result from the need to replace workers who die, retire, or leave the electric power industry for other reasons.

People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

Earnings in the electric utility industry are relatively high. In 1976, nonsupervisory employees in private electric power companies averaged $6.60 an hour. By comparison, the average for all nonsupervisory workers in private industry, except farming was $4.87 an hour.

Because supplying electricity is a 24-hour, 7-day-a-week activity, some employees work evenings, nights, and weekends, usually on rotating shifts. Most union contracts with electric utilities provide a higher rate of pay for evening and nightwork than the basic day rate.

Overtime work often is required, especially during emergencies such as floods, hurricanes, or storms. During an "emergency callout," which is a short-notice request to report for work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at 1 1/2 times the basic hourly rate. Travel time to and from the job is counted as worktime.

In addition to these provisions that affect pay, electric utilities provide other employee benefits. Generally, annual vacations are granted to workers according to length of service. A typical contract or employee benefit program provides for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 10 years, and 3 weeks for 10 to 20 years. Some contracts and programs provide for 4 weeks after 18 years, 5 weeks after 25 years, and 6 weeks after 30 years. The number of paid holidays ranges from 6 to 12 a year. Nearly all companies have benefit plans for their employees. A typical program provides life, hospitalization, and surgical insurance and paid sick leave. Retirement pension plans supplement Federal social security payments and generally are paid for in full or in part by the employer.

Because of the dangers of electrocution and other hazards, electric utilities and unions have made intensive efforts to enforce safe working practices. This has resulted in an injury rate lower than in most manufacturing industries. However, some occupations, especially those on linecrews, are more subject to accidents than others.

Many nonsupervisory electric utility workers in production, transmission, and distribution departments are union members. The bargaining representative for most of these workers is either the International Brotherhood of Electrical Workers or the Utility Workers Union of America. Independent unions represent some utility workers.

Sources of Additional Information

Information about jobs in the electric power industry is available from local electric utility companies, from industry trade associations, or from the local offices of unions that represent electric utility workers. Additional information also may be obtained from:

Edison Electric Institute, 90 Park Ave., New York, N.Y. 10016.

International Brotherhood of Electrical Workers, 1125 15th St. NW., Washington, D.C. 20005.

Utility Workers' Union of America, 815 16th St. NW., Washington, D.C. 20006.

POWERPLANT OCCUPATIONS

Nature of the Work

Powerplants employ many different types of workers to produce electricity. All equipment in the plants must be kept in good running order; thus the machinery must be regularly cleaned and serviced, and all operations carefully checked and controlled. Maintenance personnel, including electrical, instrument, and mechanical repairers, inspect and repair this equipment. For example, an instrument repairer may notice that a gauge connected to a turbine does not register properly. The repairer may disassemble the gauge, locate the specific problem, and replace a part if necessary.

Other powerplant workers include helpers and cleaners, and the custodial staff, including janitors and guards. In steam generating plants using coal for fuel, coal handlers also are employed. In hydroelectric plants, gate tenders open and close the headgates that control the flow of water to turbines. Supervision of powerplant operations is handled by chief engineers called operations supervisors, and by their assistants, watch engineers (also called shift supervisors).

Operators are the key workers in a powerplant. They include four basic classes of workers—switchboard, boiler, turbine, and auxiliary equipment operators. Their job is to observe and regulate the various kinds of powerplant equipment, keep records of all operations to make certain that equipment functions efficiently, and to detect any trouble that may arise. In this way, operators ensure that power production will not be interrupted.

Switchboard operators (D.O.T 952.782) control the amount of electric power flowing from generators to outgoing powerlines by watching instrument panels and by operating switchboards. Switches control the movement of electric current

through the generating station circuits and onto the transmission lines. Instruments mounted on panelboards show the power demand on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage.

The operators use switches to distribute the power demands among the generators, to combine the current from two or more generators, and to regulate the flow of the electricity onto various powerlines according to the changing needs of consumers. When power requirements change, they order generators started or stopped and, at the proper time, connect them to the power circuits in the station or disconnect them. In doing this, they follow telephone orders from the load dispatcher who directs the flow of current throughout the system.

Switchboard operators and their assistants also check their instruments frequently to see that electricity is moving through and out of the powerplant properly, and that correct voltage is being maintained. Among their other duties, they keep records of all switching operations and of load conditions on generators, lines, and transformers. They obtain this information by making regular meter readings.

Boiler operators (D.O.T. 950.782)—employed only in steam-powered generating plants—are responsible for maintaining the proper steam pressure needed to turn the turbines. They note and regulate the fuel, air, and water supply used in the boilers using control valves, meters, and other instruments which are mounted on panel boards. The size of the generating unit determines the number of boilers used; thus a boiler operator may be responsible for operating one or several boilers.

Turbine operators (D.O.T. 952.138) control the turbines that drive the generators. In small plants, they also may operate auxiliary equipment or a switchboard. Since modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures, the operator must give close attention to the pressure gauges, thermometers, and other instruments showing the operations of the turbo-generator unit. Turbine operators record the information shown by these instruments and check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers that change the steam back into water. They also are responsible for starting and shutting down the turbines and generators, as directed by the switchboard operator in the control room. Other workers, such as helpers and junior operators, assist the turbine operators.

Auxiliary equipment operators (D.O.T. 952.782) check and record the readings of instruments that indicate the operating condition of pumps, fans, blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. Precise operation of this machinery is directly related to the proper functioning of boilers and turbines. For example, after steam goes through the turbines, it enters the condensers. Here the steam becomes water. This operation of the condensers provides some of the force that drives the turbines. Since auxiliary equipment may occasionally break down, these operators must be able to detect trouble quickly, and sometimes make minor repairs. In small plants which do not employ auxiliary equipment operators, these duties are performed by turbine operators.

In most powerplants constructed in recent years—including nuclear—the operation of boilers, turbines, auxiliary equipment, and the switching required for balancing generator output has been centralized in a single control room. From here, central *control room operators* (D.O.T. 950.782) or powerplant operators regulate all the generating equipment, which in older plants requires specialists such as boiler and turbine operators. Control room operators have several assistants who patrol the plant and check the equipment. When equipment is not operating properly, operators report problems to the plant superintendent or a watch engineer.

Watch engineers or shift supervisors (D.O.T. 950.131) oversee the workers in the powerplant who operate and maintain the boilers, turbines, generators, transformers, switchboards, and other machinery and equipment. Watch engineers are supervised by a chief engineer or a plant superintendent who is in charge of the entire plant. In small plants, the watch engineer also may be the general plant supervisor.

Generally, a nuclear-powered plant requires about the same kind and number of employees as a steam-generating plant powered by coal. However, nuclear plants employ a few additional employees such as health and safety specialists.

Operators check and record the readings of instruments.

Training, Other Qualifications, and Advancement

New powerplant workers generally begin at the bottom of the ladder—usually on cleanup jobs. Such work gives beginners an opportunity to become familiar with the equipment and the operations of a powerplant. They advance to the more responsible job of helper as openings occur. Formal apprenticeships in these jobs are uncommon. Applicants generally are required to have a high school or vocational school education.

It takes from 1 to 3 years to become qualified as an auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be an auxiliary equipment operator progresses from helper to junior operator to operator. A boiler operator generally spends from 2 to 6 months as a laborer before being promoted to the job of helper. Depending on openings and the worker's aptitude, the helper may advance to junior boiler operator and eventually to boiler operator, or transfer to the maintenance department and work up to boiler repairer. Turbine operators advance from the ranks of auxiliary equipment operators.

Where a utility system has a number of generating plants of different size, operators usually first get experience in the smaller stations and then are promoted to jobs in the larger stations as vacancies occur. Thus, how rapidly a worker advances also may depend on the availability of openings. If these are few, it may take longer to obtain a particular job than just to learn it.

In many States and large cities, employees who operate equipment in powerplants must be licensed by local or State agencies. While licensing requirements often vary from place to place, the National Institute for the Uniform Licensing of Power Engineers (NIULPE) is attempting to standardize these requirements.

Some powerplant workers employed in atomic-powered electric plants must have special training to work with nuclear fuel, in addition to the knowledge and skills required for conventional steam-generated electric power. All control room operators, assistant control room operators, and some operators of high pressure auxiliary equipment in nuclear powerplants must be licensed by the Nuclear Regulatory Commission.

New workers in the switchboard operators section begin as helpers, advance to junior operators, and then to switchboard operators. Some utility companies promote substation operators to switchboard operating jobs. The duties of both classes of operators have much in common. Switchboard operators can advance to work in the load dispatcher's office.

Watch engineers are selected from among experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator usually are required to qualify for a watch engineer's job.

Employment Outlook

Employment of powerplant operators is expected to increase more slowly than the average for all occupations through the mid-1980's, even though the production of electrical energy will increase at a rapid rate. Although some new jobs will become available, most job openings will occur because of the need to replace workers who retire, die, or leave the industry for other work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy these companies seldom lay off employees.

Because of the increased demand for electric power, it will be necessary to build and operate many new generating stations. The use of larger and more efficient equipment, however, will result in a great increase in capacity and production without a corresponding increase in the number of powerplant operators. For example, it takes only one turbine operator to control a turbo-generator regardless of the generator's size. Also, automatic equipment makes it possible to control several boilers from a central control room.

Earnings and Working Conditions

The earnings of powerplant workers vary by occupation and locality. The following tabulation shows estimated average hourly earnings for selected powerplant occupations in privately owned utilities in 1976.

	Average hourly earnings
Auxiliary equipment operator	$5.66
Boiler operator	7.44
Control room operator	8.26
Switchboard operator:	
Switchboard operator, Class A	7.56
Switchboard operator, Class B	7.03
Turbine operator	7.26
Watch engineer	8.67

A powerplant is typically well-lighted and ventilated, clean, and orderly, but there is some noise from the equipment.

Switchboard operators in the control room often sit at the panel boards, but boiler and turbine operators are almost constantly on their feet. The work of powerplant operators generally is not physically strenuous, particularly in the new powerplants. Since generating stations operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends, usually on rotating shifts.

Sources of Additional Information

For information concerning licensing of powerplant employees, contact State and local occupational licensing agencies in your area or write to:

National Institute for Uniform Licensing of Power Engineers, 176 W. Adam St., Suite 1914, Chicago, Ill. 60603.

TRANSMISSION AND DISTRIBUTION OCCUPATIONS

Nature of the Work

One-fourth of the workers in the electric power industry are in transmission and distribution jobs. This phase of the utility system links the electric power produced in generating plants to individual customers according to their needs. The principal workers in these jobs are those who

control the flow of electricity—load dispatchers and substation operators—and employees who construct and maintain powerlines—line installers and repairers, cable splicers, troubles ground helpers, and laborers.

Load dispatchers (D.O.T. 950.168), also called system operators or power dispatchers, control the flow of electricity throughout the area served by the utility. They operate the plant equipment used to generate electricity and direct its flow. The load dispatcher's source of information for the entire transmission system is the pilot board. This board, which dominates the load dispatcher's room, is a complete map of the utility's transmission system. It enables the dispatcher to determine, at a glance, the existing conditions at any point in the system. Often lights are connected to the pilot board, which show the positions of switches that control generating equipment and transmission circuits, as well as high-voltage connections with substations and large industrial customers. The board also may have meters and several recording instruments that make a graphic record of operations for future analysis and study.

Because it takes some time to change the level of electricity being produced, the load dispatcher must anticipate power demands so that the system will be prepared to meet them. Power demands on utility systems may change from hour to hour. A sudden afternoon rainstorm, for example, may cause a million lights to be switched on in a matter of minutes. Dispatchers telephone instructions to the switchboard operators at the generating plants and the substations, telling them when to start or stop additional boilers and generators so that power production will be in balance with power needs.

Dispatchers also direct the handling of any emergency situation, such as transformer or transmission line failure, and route current around the affected area. They also may be in charge of interconnecting their utility system with other systems and directing transfers of current between systems as the need arises.

Substation operators (D.O.T. 952.782) generally are responsible for the operation of the step-up or step-down substations. A step-up substation usually is located adjacent to the powerplant to raise the voltage of the electricity so it can travel long distances. A step-down substation, at the other end of the transmission lines, reduces power voltage before it is sent out to the customer. Under orders from the load dispatcher, these operators use a switchboard to direct the flow of current out of the station. Ammeters, voltmeters, and other types of instruments register the amount of electric power flowing through each line. The flow of electricity from the incoming to the outgoing lines is controlled by circuit breakers. The substation operators, using switchboard levers that control the circuit breakers, connect or break the flow of current. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls converters which perform the change.

In addition to switching duties, substation operators check the operating condition of all equipment to make sure that it is working properly. They supervise the activities of the other substation employees on the same shift. In smaller substations, the operator may be the only employee.

Some utilities employ a mobile operator who drives from one automatic station to another, inspecting powerlines, operating controls, and assisting customers' electricians in large commerical or governmental installations.

Line installers and repairers (D.O.T. 821.381) make up the largest single occupation in the industry. They construct and maintain the network of powerlines that carries electricity from generating plants to consumers.

Installers bolt crossarms to transmission poles and then bolt or clamp insulators in place on the crossarms. Next, they raise wires and cables and attach them to the insulators. Other equipment, such as lightning arrestors, transformers, and switches, also must be attached to the poles. Any routine maintenance and replacements necessary are performed by line installers and repairers.

When wires, cables, or poles break, it means an emergency call for a linecrew. Line repairers splice or replace broken wires and cables and replace broken insulators or other damaged equipment. Most installers and repairers now work from "bucket" trucks with pneumatic lifts that take them to the top of the pole at the touch of a lever.

In some power companies, linecrew employees specialize in particu-

Line installers constructing underground electric power lines.

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lar types of work. Those in one crew may work on new construction only, and others may do only repair work.

Trouble shooters (D.O.T. 821.281) are experienced line installers and repairers who are assigned to special crews that handle emergency calls. They move from one job to another, as ordered by a central service office that receives reports of line trouble. Often troubleshooters receive their orders by direct radio communications with the central service office.

To do this job well, these workers must have a thorough knowledge of the company's transmission and distribution network. Upon reaching the location of the break, they first find and report the source of trouble, and then attempt to restore service by making the necessary repairs. For example, depending on the nature and extent of the problem, troubleshooters may have to install new fuses or cut down live wires. They must be familiar with all the circuits and switching points so that they can safely disconnect live circuits when lines break down.

Ground helpers (D.O.T. 821.887) assist in constructing, repairing, and maintaining the transmission and distribution lines. For example, they dig pole holes, and then help the line installers and repairers to raise the poles while positioning them into the holes.

Cable splicers (D.O.T. 829.381) supervise the installation of insulated cables on utility poles and towers, as well as those buried underground and those carried in underground conduits. When cables are installed, these workers direct the laying of the conduit and the pulling of the cable through it. The cables are joined at connecting points in the transmission and distribution systems. At each connection—or break in the system—insulation is wrapped around the wiring and the cable is sealed with lead sheathing. Most of the physical work in placing new cables or replacing old ones is done by laborers.

Cable splicers spend most of their time repairing and maintaining cables and changing the layout of the cable systems. They must know the arrangement of the wiring systems, where the circuits are connected, and where they lead to and come from. When making repairs, they must make sure that the continuity of each line is maintained from the substation to the customer's premises. Cable splicers also periodically check insulation on cables to make sure it is in good condition.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from experienced switchboard operators and from operators of large substations. Usually, 7 to 10 years of experience as a senior switchboard or substation operator are required for promotion to load dispatcher. To qualify for this job, an applicant must have thorough knowledge of the entire utility system. Substation operators generally begin as assistant or junior operators. Advancement to the job of operator in a large substation requires from 3 to 7 years of on-the-job training.

About 4 years of on-the-job training are needed to qualify as a skilled line installer and repairer. New workers usually begin training as ground helpers, and assist the line installers and repairers. For example, they may help set poles in place or pass tools and equipment. Some companies have formal apprenticeship programs for line employees. Apprenticeship programs combine on-the-job training with classroom instruction in blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical energy. After about 6 months, apprentices begin to do simple linework under close supervision, and progress to more difficult work as they gain experience. A line installer and repairer may advance to troubleshooter after several years of experience.

Candidates for linework should be strong and in good physical condition because climbing poles and lifting lines and equipment is strenuous. They also must have steady nerves and good balance to work at the top of the poles and to avoid the hazards of live wires and falls.

Most cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

Several thousand job opportunities are expected to be available in transmission and distribution occupations through the mid-1980's. Most of these opportunities will occur because of the need to replace experienced workers who retire, die, or transfer to other fields of work. Workers hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Some increase in the employment of transmission and distribution workers is expected, although employment trends will differ among the various occupations in this category. In spite of the need to construct and maintain a rapidly growing number of transmission and distribution lines, the number of line installers and repairers and troubleshooters is expected to increase only slightly because of the use of more mechanized equipment. A limited increase in the number of cable splicers is expected because of the growing use of underground lines in suburban areas. The need for regular substation operators, however, will be reduced substantially, since the introduction of improved and more automatic equipment makes it possible to operate more substations by remote control.

Earnings and Working Conditions

Wages for transmission and distribution workers vary by occupation and geographic location. The following tabulation shows estimated average hourly earnings for major transmission and distribution occupations in privately owned utilities in 1976.

	Average hourly earnings
Ground helper	$5.37
Line installer and repairer	7.97
Load dispatcher	8.38
Substation operator	7.14
Trouble shooter	9.15

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Line installers and repairers, troubleshooters, and ground helpers work outdoors, and in emergencies, may work in all kinds of weather. Cable splicers do most of their work beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of labor unions, have greatly reduced the hazards of these jobs. Workers stringing high voltage lines, for example, protect themselves by wearing rubber gloves. Also, barricades and specific warning signs usually are posted where workers lay conduits or run wires underground.

Meter readers go to customers' homes to record electricity used.

CUSTOMER SERVICE OCCUPATIONS

Nature of the Work

Workers in customer service occupations include people who read, install, test, and repair meters so that the utility company can accurately charge customers for their consumption of electric power. Also included are workers who represent the utility company in rural areas, and appliance repairers who work in company-operated shops, fixing customers' electrical equipment.

Electric meter repairers (D.O.T. 729.281) are the most skilled workers in this group. Their main duties are to maintain and repair meters, although they also may install and test meters. Some of these workers specialize in repairing simpler types of meters, such as those in homes. Others can handle all kinds of meters, including the more complicated ones used in industrial plants where large quantities of electric power are consumed. Often, some of the large systems require specialists, such as *meter installers* (D.O.T. 821.381) who put in and take out meters, and *meter testers* (D.O.T. 729.281).

Meter readers (D.O.T. 239.588) go to customers' premises to check the meters that register the amount of electric energy used. They record the amount used during the current billing period and watch for, and report, any tampering with meters.

District representatives usually serve as company agents in outlying districts that are too small to justify more specialized workers and in localities where the utility company does not have an office. They collect overdue bills; make minor repairs; and read, connect, and disconnect meters. They receive service complaints and reports of line trouble from customers, and send them to a central office.

Appliance repairers are discussed in a separate chapter elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Meter repairers begin their jobs as helpers in the meter testing and repair departments. Persons entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training are required to become thoroughly familiar with all types of repairs. Some companies have formal apprenticeship programs in which the trainee progresses according to a specific plan.

Inexperienced workers can qualify as meter readers after a few weeks of training. Beginners accompany the experienced meter reader on the rounds until they have learned the job.

The duties of district representatives also are learned on the job. An important qualification for this occupation is the ability to deal tactfully with the public in handling service complaints and collecting overdue bills.

Employment Outlook

Employment in customer service occupations is expected to show little change through the mid-1980's. The need for meter readers will be limited because of the trend toward less frequent readings. Moreover, automatic meter reading may become more common, and new meters will require less maintenance. However, some job openings for meter repairers and meter readers will occur each year because of the need to replace workers who retire, die, or transfer to other fields of work. People hired by electric power companies are likely to have relatively secure jobs. Even during downturns in the economy, these companies seldom lay off employees.

Earnings and Working Conditions

The earnings of customer service workers vary according to the type of job they have and the section of the country in which they work. The following tabulation shows estimated average hourly earnings for major customer service jobs in privately owned utilities in 1976.

	Average hourly earnings
District representative	$8.14
Meter repairer A	7.26
Meter repairer B	6.43
Meter reader	5.78

OCCUPATIONS IN THE MERCHANT MARINE INDUSTRY

In 1976, the merchant marine industry employed about 100,000 people in a variety of occupations that require different levels of skill and education. Many of these jobs are found only in the merchant marine industry.

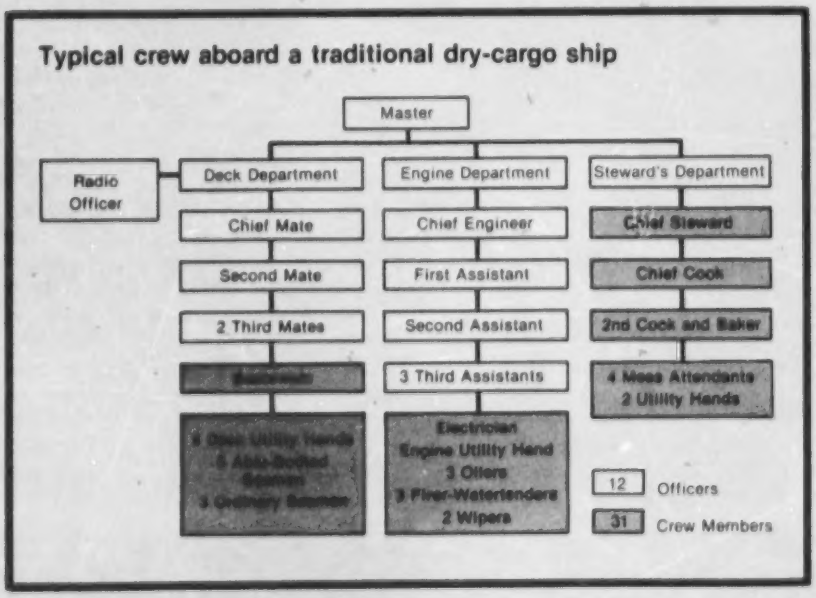
Nature and Location of the Industry

The merchant marine consists mainly of private firms that carry foreign and domestic commerce aboard oceangoing vessels. In late 1976, nearly all of the 521 ships in the active fleet were privately owned. The small number of government-owned ships in the merchant marine are operated by the Navy's Military Sealift Command (MSC) and have civilian crews.

Nearly three-fifths of the ships in our merchant fleet are freighters. These include general cargo ships and special vessels, such as roll-on-roll-off container ships. About two-fifths of the ships are tankers that carry liquid products, such as oil, mostly between the Nation's Gulf and Atlantic Coast ports. Several ships are combination passenger-cargo carriers.

Many ships operate on a regular schedule to specific ports. Others sail for any port promising cargo. The size of a crew depends on the type of vessel. Cargo ships and tankers have crews varying from 13 to 65 persons; passenger ships may have crews of 300 or more.

Most shoreside employees in the industry work in the country's major port cities, and most officers and sailors have home bases in these cities. The Nation's largest port is New York. Other major Atlantic ports are Boston, Philadelphia, Baltimore, Norfolk, Charleston, Savannah, and Jacksonville. Gulf ports that handle large volumes of cargo include New Orleans, Houston, Galveston, and Tampa. Shipping on the West Coast is concentrated in the areas of San Francisco, Los Angeles, Seattle, and Portland.



Occupations in the Industry

Almost half of the merchant marine industry's employees are officers and sailors who make up ship crews. Most of the industry's shoreside employees are dockworkers who load and unload ships. A small number of workers have administrative and clerical jobs.

Ship Crews. The *captain* (D.O.T. 197.168) or master, has complete authority and responsibility for the ship's operation, and the safety of the crew, passengers, and cargo. Under the supervision of the captain, the work aboard ship is divided among the deck, engine, and steward departments.

Deck officers (D.O.T. 197.133), under orders from the captain, direct movement of the ship and the maintenance of the deck and hull. *Boatswains* (D.O.T. 911.131) supervise deck crews and see that deck officers' orders are carried out. *Able seamen* (D.O.T. 911.884) steer the ship and report sightings to the deck officer. *Ordinary seamen* (D.O.T. 911.887), the entry rating in the deck department, do general maintenance work such as chipping rust, painting, and splicing and coiling ropes. *Deck utility hands* (D.O.T. 911. 884) and *ship's carpenters* (D.O.T. 860.281) also are employed on some vessels to maintain the ship's deck and hull.

Marine engineers (D.O.T. 197.136) are responsible for starting, stopping, and controlling the speed of the main engines and the operation of all other machinery aboard ship. They also direct sailors, such as oilers and wipers, in the lubrication and maintenance of engines, pumps, and other equipment. *Oilers* (D.O.T. 911.884) lubricate moving parts of mechanical equipment. *Wipers* (D.O.T. 699.887) keep the engine-room and machinery clean. *Firers-watertenders* (D.O.T. 951.885) regulate fuel gauges and the amount of water in the boilers. The *ship's electrician* (D.O.T. 825.281) repairs and

maintains electrical equipment, such as generators and motors.

The *chief steward* (D.O.T. 350.138) supervises the preparation of meals and the upkeep of living quarters aboard ship. The *chief cook* (D.O.T. 315.131) and assistant cooks prepare meals. *Utility hands* (D.O.T. 318.887) carry food supplies from the storeroom, prepare vegetables, and wash cooking utensils. *Mess attendants* (D.O.T. 350.878) set tables, serve meals, wash dishes, and care for living quarters.

Most ships employ *radio officers* (D.O.T. 193.282), who keep contact with the shore and other ships and maintain the radio equipment. Some cargo ships and all passenger vessels carry *pursers* (D.O.T. 197.168), who prepare the necessary papers to allow ships to enter or leave port.

Occupations aboard ship are discussed in detail elsewhere in the *Handbook* in the statements on merchant marine officers and merchant marine sailors.

Dock Workers. Many workers are needed to load and unload ships. Terminal managers are responsible for hiring dockworkers called *stevedores* (D.O.T. 911.883). Gang bosses supervise crews of stevedores who load and unload ships and move cargo in and out of warehouses. Some operate materials handling equipment, such as lift trucks and cranes. Stevedores also position and fasten hose lines to the ship's tanks when loading or unloading liquid cargo, such as chemicals and oil.

Clerical Occupations. The merchant marine industry employs workers in general clerical jobs, such as payroll clerk, secretary, and typist. Other clerical workers have specialized jobs. *Billing clerks* (D.O.T. 219.388) type invoices that list items shipped and dates of shipment. *Clerks and dispatchers, pilot station,* (D.O.T. 911.368) keep records of ships entering ports. *Manifest clerks* (D.O.T. 219.388) compile and type the ship's manifest (a list of passengers and cargo) for use at customhouses or terminals. *Receipt and report clerks* (D.O.T. 911.388) prepare reports on labor and equipment costs for loading and unloading cargoes.

Administrative and Professional Occupations. The merchant marine industry employs a small number of administrative and other office personnel. Executives plan and administer company policy. The industry also employs accountants, lawyers, and labor relations and personnel workers. Some *marine architects* (D.O.T. 001.081) are employed to oversee the construction and repair of ships.

Training, Other Qualifications, and Advancement

Inexperienced workers may be hired as stevedores to load and unload cargo. Applicants must be in good physical condition. A high school education is preferred but not required. Under the guidance of experienced workers, stevedores can learn their jobs in a few weeks. As vacancies occur, they can advance to jobs such as lift truck operator and crane operator. Workers who have supervisory ability may become gang bosses.

No educational requirements are established for jobs aboard ship, but a good education is an advantage. Formal training for officers is conducted at the U.S. Merchant Marine Academy, at five State merchant marine academies, and through programs operated by trade unions. Unions also conduct training programs to upgrade the ratings of sailors.

To obtain an officer's license, a candidate must be a U.S. citizen, be physically fit, and pass a written examination administered by the U.S. Coast Guard. Sailors also must obtain licenses (merchant mariner's documents) from the Coast Guard. Applicants are required to pass a physical examination and present proof that they have a job offer aboard a U.S. merchant vessel.

Persons who are considering a career at sea must be able to live and work with others as a team. Although peace time service is relaxed, they must adjust to some military-like discipline that is essential because of the nature of shipboard life.

Most general clerical occupations, such as secretary or bookkeeper, usually require the completion of basic commercial courses in high school or business school. Additional on-the-job training is necessary for specialized clerical occupations, such as manifest clerk and receipt and report clerk.

Administrative positions usually are filled by college graduates who have degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. A knowledge of the merchant marine industry is helpful. Marine architects must be licensed professionals. Requirements for licensing are set by the individual States and generally include graduation from an accredited professional school followed by 3 years of practical experience in an architect's office.

Employment Outlook

Little or no change in employment in the merchant marine industry is expected through the mid-1980's. Nevertheless, some openings will arise each year from the need to replace experienced workers who retire, die, or transfer to other fields.

Because of substantially higher shipbuilding and labor costs, our merchant fleet finds it difficult to compete in the world shipping market. To insure that our country has a merchant fleet operating in regular or essential trade routes, the Government subsidizes many ships. In 1970, the Government also passed a law which would subsidize the construction of 30 new ships annually over a 10-year period and to improve tax incentives for firms to buy new ships. Despite this support, the size of our merchant fleet probably will not grow significantly, since the number of ships to be built is expected to only slightly exceed the number of older vessels taken out of service.

Little or no change in the employment of ship's officers is expected over the long run. Employment of sailors, on the other hand, is expected to decline because new ships are equipped with laborsaving innovations, such as automated enginerooms, which reduce the need for these workers.

Employment trends also will vary among shoreside occupations. The greater use of containerized cargo

ships and improvements in materials handling equipment will reduce the need for stevedores. Employment in administrative and clerical occupations, on the other hand, is not expected to change significantly.

Earnings and Working Conditions

Stevedores working along the Atlantic and Gulf Coasts earned $8 an hour in 1976, and those on the Pacific Coast earned $7.52 an hour. Stevedores also earn extra pay for handling hazardous cargo.

Earnings aboard ships are relatively high; all officers earned a base pay of over $1,000 a month in 1976. Sailors who have advanced a rung or two in rating could receive a base pay of over $700 a month. In addition, both officers' and sailors' earnings are supplemented by premium pay for overtime or for assuming extra responsibilities. On the average, additional payments for assuming extra work or responsibility add about 50 percent to base pay. Shipboard workers also receive free meals and lodging while at sea.

Since ship's crewmembers and stevedores are subject to occasional layoff, however, their annual earnings usually are not as high as the hourly rates and monthly salaries would imply.

Most shoreside workers in the industry work a 5-day, 40-hour week. The workweek for people aboard ships is considerably different. Most officers and sailors are required to stand watch, working split shifts around the clock. Generally, they work two 4-hour shifts during every 24-hour period and have 8 hours off between each shift. Other officers and sailors are on duty 8 hours a day, Monday through Friday.

The merchant marine industry provides excellent fringe benefits. Most employers provide paid vacations and holidays. Vacations for sailors and officers range from 90 to 180 days a year. Many firms also provide other benefits such as life, health, and accident insurance. Officers and sailors may retire on full pension after 20 years of service, regardless of age. Stevedores are eligible for pension at age 65.

Working and living conditions aboard ship have improved over the years. Mechanization has reduced the physical demands, and newer vessels have private rooms, air-conditioning, television, and better recreational facilities. However, life aboard ship is confining, and since voyages last several weeks or months, officers and sailors are away from their homes and families much of the time. Some tire of the lengthy separations and choose shoreside employment. However, for many people, the spirit and adventure of the sea, good wages, and fringe benefits more than compensate for the disadvantages.

The duties aboard ship are hazardous compared with other industries. At sea, there is always the possibility of injury from falls or the danger of fire, collision, or sinking. Most shoreside jobs are not hazardous, but stevedores may do heavy lifting and risk injury from falling boxes and other freight when loading and unloading ships.

Most employees are union members. All stevedores are represented by either the International Longshoremen's Association or the International Longshoremen's and Warehousemen's Union. Most officers aboard ships are represented by the International Organization of Masters, Mates and Pilots; and the National Marine Engineers Beneficial Association. Sailors are members of the National Maritime Union of America and the Seafarers' Union.

Sources of Additional Information

For general information about jobs in the merchant marine, write to:

Office of Maritime Manpower, Maritime Administration, U.S. Department of Commerce, Washington, D.C. 20235.

Information about job openings and wages aboard ships can be obtained from local maritime unions. If such a union is not listed in the local telephone directory, contact:

National Maritime Union of America, 36 Seventh Ave., New York, N.Y. 10011.

Seafarers' International Union of North America, 675 Fourth Ave., Brooklyn, N.Y. 11232.

National Marine Engineers, Beneficial Association, 17 Battery Pl., New York, N.Y. 10004.

Further information about stevedore jobs is available from:

International Longshoremen's Association (AFL-CIO), 17 Battery Pl., New York, N.Y. 10004.

International Longshoremen's and Warehousemen's Union (AFL-CIO), 150 Golden Gate Ave., San Francisco, Calif. 94102.

OCCUPATIONS IN RADIO AND TELEVISION BROADCASTING

The glamour and excitement of radio and television make broadcasting careers attractive to many people. In 1976 about 130,000 full-time and 30,000 part-time workers were employed in broadcasting; slightly more than half were in radio and the rest were in television. In addition, several thousand freelance artists, mostly writers, performers, and musicians, work on a contract basis for stations, networks, and other producers. Several thousand other employees work for independent producers in activities closely related to broadcasting, such as the preparation of filmed and taped programs and commercials.

Broadcasting stations offer a variety of interesting jobs in all parts of the country. Opportunities for entry jobs are best at stations in small communities, although the highest paying jobs are in large cities, especially those with national network stations.

Nature and Location of the Industry

Commercial broadcasting. In 1976 about 7,250 commercial radio stations and 720 commercial television stations were in operation in the United States. Most commercial radio broadcasting stations are small, independent businesses. The average station employs about 11 full-time and 4 part-time workers. The smallest radio stations employ only four or five people while radio stations in large cities may have 100 employees or more. Television stations average about 75 full-time and 10 part-time employees. However, many television stations are smaller than this, while some are much larger. A television station in a small market may employ only 30 people, while a station in a major metropolitan area may employ up to 250 people. Commercial radio stations are served by seven nationwide networks and a large number of regional networks. Stations can affiliate with networks by agreeing to broadcast their programs on a regular basis. The seven national radio networks employed approximately 1,000 workers in 1975.

Most television stations depend on one of three national television networks for programs that would be too expensive for individual stations to originate—for example, sports events or newscasts of national and international significance. These networks, in turn, can offer national coverage to sponsors. As many as 200 stations across the country may carry a network television show. In 1975 the three national networks employed about 13,000 workers. Most network programs originate in New York City or Los Angeles.

Public broadcasting. There were about 850 noncommercial radio stations (mainly FM) and 270 educational television stations in 1976. These stations are operated principally by educational agencies such as State commissions, local boards of education, colleges and universities, and special community public television organizations. Educational stations employed more than 9,000 full-time and over 4,000 part-time workers in 1976.

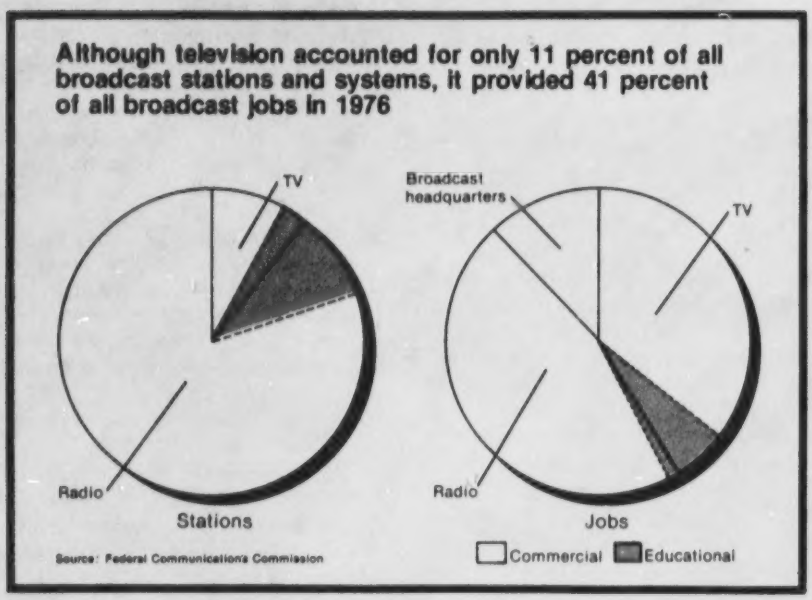
Cable television. There were also about 3,570 cable TV systems (CATV) employing about 25,000 workers in 1976.

Station personnel preparing for a newscast.

Broadcasting Occupations

Nearly half of all employees in the broadcasting industry hold professional and technical jobs, such as announcers, anchors and news persons, writers, or broadcast technicians. Clerical and sales workers make up an additional 30 percent, and managerial personnel make up about one-fifth. Many of the remaining employees are craft workers, such as electricians and carpenters.

Jobs vary greatly between small and large stations. In small stations, the station manager, who frequently is the owner, may act as sales manager, or perhaps as program director, announcer, and copywriter. An-



nouncers in small stations may do their own writing, operate the studio control board, and do sales work. The engineering staff may consist of only one full-time broadcast technician assisted by workers from the other departments. In large radio and television stations, jobs are specialized. Traditionally, radio and television stations maintain four major departments: programming, engineering, sales, and general administration. An increasing number of stations have created a separate department for news; elsewhere, news personnel work in the programming department. The kinds of jobs found in each of the four departments are described in the following paragraphs.

Programming Department. Staff members produce daily and weekly shows, assign personnel to cover special events, and provide general program services such as sound effects and lighting. From time to time, freelance performers, writers, singers, and other entertainers are hired for specific broadcasts, for a series of broadcasts, or for special assignments.

The size of a station's programming department depends on the extent to which its broadcasts are live, recorded, or received from a network. In a small station, a few people make commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. In a large station, on the other hand, the program staff may consist of a large number of people in a wide variety of specialized jobs.

Program directors are responsible for the overall program schedules of large stations. They arrange for a combination of programs that will be attractive and interesting to the audience and at the same time effectively meet the needs of advertisers.

Traffic managers prepare daily schedules of programs and keep records of broadcasting time available for advertising. *Continuity directors* are responsible for the writing and editing of all scripts. They may be assisted by *continuity writers*, who prepare announcers' books ("copy") that contain each programs script and commercials along with their sequence and length.

Directors plan and supervise individual programs or series of programs. They coordinate the shows, select artists and studio personnel, schedule and conduct rehearsals, and direct on-the-air shows. They may be assisted by *associate directors*, who work out detailed schedules and plans, arrange for distribution of scripts and changes in scripts to the cast, and help direct on-the-air shows. Some stations employ *program assistants* to aid directors and associate directors. Assistants help assemble and coordinate the various parts of the show. They arrange for props, makeup service, artwork, and film slides and assist in timing. They cue the performers, using cue cards prepared from scripts.

Community and public affairs directors are a link between the station and schools, churches, citizen groups, and civic organizations. They supervise, write, and host public affairs programs.

In large stations, directors may work under the supervision of a *producer*, who selects scripts, controls finances, and handles other production problems. Many times these functions are combined in the job of *producer-director*.

Announcers are the best known group of program workers. Announcers introduce programs, guests, and musical selections and deliver most of the live commercial messages. In small stations, they also may operate the control board, sell time, and write commercial and news copy. Broadcast announcers are discussed in detail elsewhere in the *Handbook*.

Music is an important part of radio programming. Both small and large stations use recordings and transcriptions to provide musical programs and background music for other shows. Large stations, which have extensive music libraries, sometimes employ *music librarians* to maintain music files and answer requests for any particular selection of music. The networks have specialized personnel who plan and arrange for musical services. *Musical directors* select, arrange, and direct music for programs following general instructions from program directors. They select musicians for live broadcasts and direct them during rehearsals and broadcasts. Musicians are generally hired on a freelance basis.

News gathering and reporting is a key aspect of radio and television programming. *News directors* plan and supervise all news and special events coverage. *News reporters* broadcast daily news programs and report special news events on the scene. *News writers* select and write

copy for newscasters to read on the air. In small stations, the jobs of news reporter and news writer often are combined.

Stations that originate live television shows must have staff members who take care of staging the programs. *Studio supervisors* plan and supervise the setting up of scenery and props. *Floor managers* plan and direct the performers' positions and movements on the set according to directors' instructions. The jobs of studio supervisor and floor manager often are combined. *Property handlers* set up props, hold cue cards, and do other unskilled chores. *Make-up artists* prepare personnel for broadcasts by applying cosmetics. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other props to help convey the desired visual impressions. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire or rain.

Almost all commercial television programming is recorded either on film or video tape. Broadcast technicians make video tape recordings on electronic equipment that permits instantaneous playback of a performance. Video tape is used to record live shows and to prerecord programs for future broadcasts. Many stations employ specialized staff members to take care of filmed program material. *Film editors* edit and prepare all film for on-the-air presentation. They screen all films received, cut and splice films to insert commercials, and edit locally produced film. *Film librarians* catalog and maintain files of motion picture film.

Engineering Department. Technicians position microphones, adjust levels of sound, keep transmitters operating properly, and move and adjust lights and television cameras to produce clear, well-composed pictures. They also install, maintain, and repair the many types of electrical and electronic equipment required for these operations.

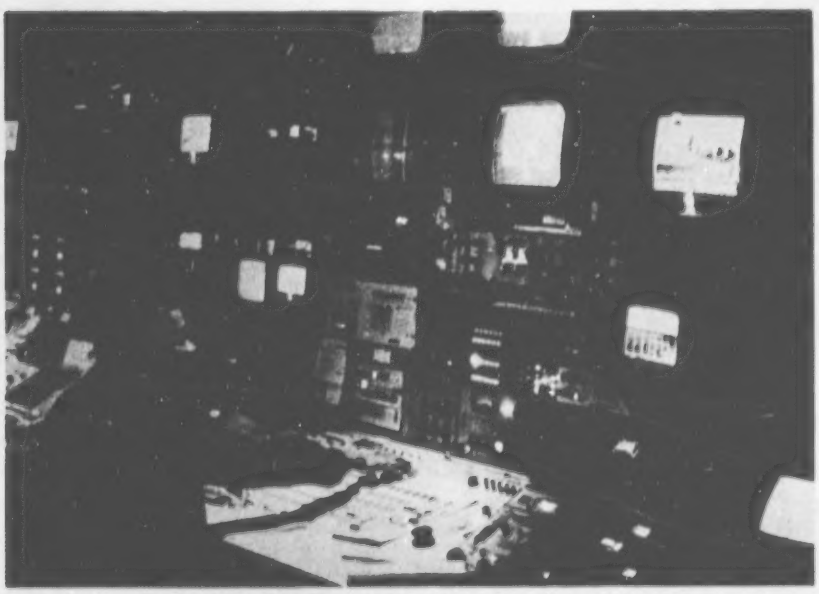
Most stations employ *chief engineers*, who are responsible for all engineering matters, including supervision of technicians. In small stations, they also may work at the control board and repair and maintain equipment. Large stations have engineers who specialize in fields such as sound recording, maintenance, and lighting. Networks employ a few *development engineers* to design and develop new electronic apparatus to meet special problems.

Broadcast technicians have many jobs. For example, they control the operation of the transmitter to keep the level and frequency of broadcast within legal requirements. They also set up, operate, and maintain equipment in the studio and in locations where remote broadcasts are to be made. (Further information on broadcast technicians is given elsewhere in the *Handbook*.)

Sales Department. *Sales representatives*, the largest group of workers in this department, sell advertising time to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the station's operations and programming. The job also requires that they be knowledgeable about the audience—including, for example, size and characteristics, number of radio and television sets in use, income levels, and consumption patterns. Sales representatives in large stations often work closely with sponsors and advertising agencies. Many television stations sell a substantial part of their time, particularly to national advertisers, through independent advertising agencies.

Large stations generally have several workers who do only sales work. The sales manager supervises them, and also may handle a few of the largest accounts personally. Some large stations employ statistical and research personnel to help analyze and report market information on the community served.

General administration. In a very small station, the owner and a bookkeeper may handle all the record-keeping, accounting, purchasing, hiring, and other routine office work. If the size of the station warrants it, the business staff may include accountants, lawyers, personnel workers, and others. They are assisted by office workers, such as secretaries, typists, bookkeepers, clerks, and messengers.



Broadcast technician in control room monitoring telecast.

Training, Other Qualifications, and Advancement

A high school diploma is sufficient for many entry-level jobs in broadcasting. For an increasing number of jobs, however, technical training or a college degree is preferred. Entry-level jobs in the engineering department, for example, require some

technical training in electronics. A college education provides a good background for many jobs in the programming, sales, and business end of broadcasting. While a major in almost any field is acceptable, many stations prefer candidates with a background in the liberal arts. Some technical schools offer courses in broadcasting, and many colleges and universities offer 2- or 4-year degree programs in broadcasting, mass communications, telecommunications, speech, and journalism.

Education beyond high school almost always is an asset in terms of career potential and advancement. A high school graduate may start working for a radio station in a sales job, for example, but opportunities to progress to the management ranks are likely to be much greater with a college degree. In the programming area, proficiency in announcing may be enough to land a job, but advancement usually requires a strong educational background in addition to administrative skills.

Television programming for networks and large independent stations generally requires some experience in broadcasting in addition to a college degree.

Some people get their start in broadcasting as clerks, typists, property handlers, or assistants. Jobs such as these do not ordinarily require specialized training or experience. They do, however, provide workers with the chance to advance to more responsible jobs as they gain knowledge and experience. A few people get started in broadcasting with temporary jobs in the summer when regular workers go on vacation and broadcast schedules of daylight-hours stations are increased.

Technical training in electronics is required for entry jobs in engineering departments. Programs in electronics are offered by trade schools and technical institutes, and also by junior and community colleges. High school courses in electronics, mathematics, and physics often are helpful to people who plan to pursue careers as broadcast technicians.

Some technical schools give courses especially designed to prepare the student for the series of written examinations required for the Federal Communication Commission's (FCC) First Class Radiotelephone Operator License. The tests cover the theory, construction, and operation of transmission and receiving equipment; the characteristics of electromagnetic waves; and U.S. and international regulations governing broadcasting. The first class license (the FCC also issues second and third class licenses) is required by law for the chief engineer, and usually is required by stations for other members of a radio or television station's engineering staff. Industry experts stress the importance of a first class license, particularly for technicians who wish to progress to the top ranks in broadcast engineering. In some metropolitan areas, where competition for jobs is keen, holders of a first class license are at an advantage in finding employment as a broadcast technician.

Small radio stations with only a few employees sometimes prefer to have as many staff members as possible who are legally qualified to operate their transmitters. Because of this, nontechnicians, especially announcers, have a better chance of getting a job in radio if they have a first class or third class license.

Entry jobs as announcers in small stations usually do not require specific training or experience, but an applicant must have a pleasant voice, a good command of the language, and other characteristics that make a dramatic or attractive personality. Courses in speech, English, social science, drama, and electronics are helpful to persons seeking careers as announcers. In addition, college campus radio experience, summer and part-time employment at local stations, and a good knowledge of the commercial industry are all highly regarded as backgrounds. Qualifications for administrative and sales jobs in broadcasting are similar to those required by other employers; a business course program of study in high school or a college degree in business or management is good preparation for such jobs.

Most beginners start out in small educational and public broadcasting stations. Although these stations cannot pay high salaries, they offer opportunities to learn the different phases of broadcasting work because they generally use personnel in combination jobs. For example, an announcer may perform some of the duties of a broadcast technician.

People in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees usually remain in programming work, although sometimes transfers to and from the sales and business departments are made. Transfers are easier between sales and general administrative departments because of their close working relationship; in fact, in small stations, they are often merged into one department. Although transfers of experienced workers between departments are limited to the extent noted, these distinctions are less important in beginning and top-level jobs. At the higher levels, a station executive may be drawn from top-level personnel of any department.

Many radio and television station managers consider training in a private trade or technical school helpful for people interested in careers in the broadcasting industry. However, before enrolling in any broadcasting school, whether public or private, prospective students should contact employers, broadcasting trade organizations, and the Better Business Bureau in their area to determine the school's performance in producing suitably trained candidates.

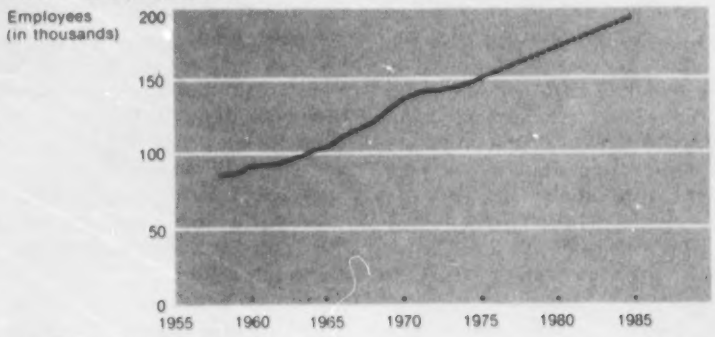
Employment Outlook

Employment in the broadcasting industry is expected to grow about as fast as the average for all industries through the mid-1980's. Besides the job openings from growth, many openings will result from the need to replace experienced workers who retire, die, or leave the industry for other reasons. Competition will be very keen for entry jobs, especially in metropolitan areas, because this field traditionally attracts large numbers of jobseekers.

New radio stations can be expected to go on the air, particularly in small communities, and will offer opportunities for additional workers. Technological developments are likely to limit employment growth in

The steady employment growth in radio and television broadcasting is expected to continue through 1985, with many of the new jobs in educational and cable television

Wage and salary workers in radio and television broadcasting, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

some broadcasting occupations. For example, automatic programming equipment that permits radio stations to provide virtually unattended programming reduces requirements for announcers.

The number of educational television stations is expected to increase as private and government groups continue to expand in this area. The growth of educational stations will increase job opportunities, especially in programming, community relations, and station management. However, such technological advances as remotely controlled transmitter and automatic programming equipment may limit employment growth in engineering and technician jobs.

Cable television (CATV) has emerged as a powerful new force in communications, and some additional job opportunities for professional, technical, and maintenance workers will be created as CATV systems increasingly originate and transmit programs. Many of these new jobs will be in small cities where most CATV systems are located to improve television reception in rural areas. By using cables instead of airwaves, CATV can offer customers a larger selection of stations plus many additional programs produced specifically for cable television.

Earnings and Working Conditions

In 1976 earnings of nonsupervisory broadcasting workers averaged $5.78 an hour, nearly one-fifth more than the average for nonsupervisory workers in private industry, except farming. Salaries vary widely among occupations and locations in the broadcasting industry. Employees in large cities generally earn much more than those in the same kinds of jobs in small towns. Salaries also tend to be higher in large stations than in small ones, and higher in television than in radio.

Most full-time broadcasting employees have a scheduled 40-hour workweek; employees in many small stations work longer hours. Sales and business employees generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, weekends, and holidays. To meet a broadcast deadline, program and technical employees in the networks may have to work continuously for many hours under great pressure.

Several unions operate in the broadcasting field. They are most active in the network centers and large stations in metropolitan areas. The National Association of Broadcast Employees and Technicians and the International Brotherhood of Electrical Workers both organize all kinds of broadcasting workers, although most of their members are technicians. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts, such as stagehands, sound and lighting technicans, wardrobe attendants, makeup artists, and camera operators. Many announcers and entertainers are members of the American Federation of Television and Radio Artists. The Directors Guild of America, Inc. (Ind.) organizes program directors, associate directors, and stage managers. The Screen Actors Guild, Inc., represents the majority of entertainers who appear on films made for television.

Sources of Additional Information

Booklets entitled "Careers in Radio" and "Careers in Television" are available from:

National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For information about colleges and universities that offer programs or course work in broadcasting, contact:

Executive Secretary, Broadcast Education Association, National Association of Broadcasters, 1771 N St. NW., Washington, D.C. 20036.

For information on careers in public radio and television broadcasting, write to:

Corporation for Public Broadcasting, 1111 16th St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE RAILROAD INDUSTRY

Trains are one of the most efficient methods of transporting large amounts of freight over distances exceeding several hundred miles. Locomotives can pull thousands of tons of cargo using fewer employees and far less fuel than trucks and airplanes. In 1976, the railroads hauled 1.4 billion tons of freight, and carried 271 million passengers as well.

With 531,000 workers in 1976, the railroads were one of the Nation's largest employers. Railroad workers operate trains, build and repair equipment and facilities, provide services to customers, and collect and account for revenue. In most nonprofessional jobs, seniority systems prevail—workers start at the bottom and work their way up.

Trains are one of the most efficient methods of transporting large amounts of freight.

Nature and Location of the Industry

The railroad industry is made up of "line-haul" railroad companies that transport freight and passengers and switching and terminal companies that provide line-haul railroads with services at some large stations and yards.

About 95 percent of all railroad employees work for line-haul companies that handle about 99 percent of the industry's business. The remainder work for switching and terminal companies. Most railroad revenue and employment comes from freight. Passenger service has declined substantially in the past 30 years, because the railroads have not been able to compete with the speed of the airlines or the convenience of private automobiles.

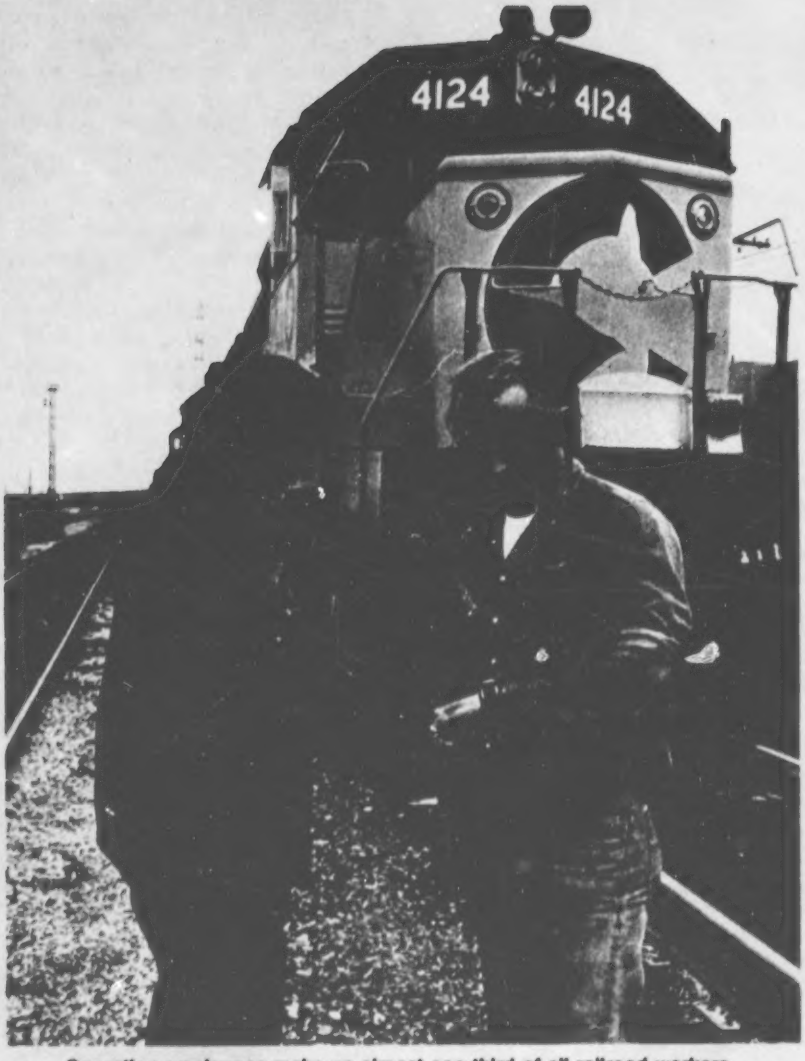
Railroad workers are employed in every State except Hawaii. Large numbers work at terminal points where the railroads have central offices, yards, and maintenance and repair shops. Chicago, the hub of the Nation's railroad network, has more railroad employees than any other area, but many employees also work at the major railroad operations centered near New York, Los Angeles, Philadelphia, Minneapolis, Pittsburgh, and Detroit.

Railroad Occupations

Railroad workers can be divided into four main groups: Operating employees; station and office workers; equipment maintenance workers; and property maintenance workers.

Operating employees make up almost one-third of all railroad workers. This group includes locomotive engineers, conductors, and brake operators. Whether on the road or at terminals and railroad yards, they work together as traincrews. Also included are switchtenders who help conductors and brake operators by throwing track switches in railroad yards and hostlers who fuel, check, and deliver locomotives from the engine house to the crew.

One-fourth of all railroad workers are *station and office employees* who direct train movements and handle the railroads' business affairs. Profes-



Operating employees make up almost one-third of all railroad workers.

sionals such as managers, accountants, statisticians, and systems analysts do administrative and planning work. Clerks keep records, prepare statistics, and handle business transactions such as collecting bills and adjusting claims. Agents manage the business affairs of the railroad stations. Telegraphers and telephoners pass on instructions to traincrews and help agents with clerical work.

More than one-fifth of all railroad employees are *equipment maintenance workers*, who service and repair locomotives and cars. This group includes car repairers, machinists, electrical workers, sheet-metal workers, boilermakers, and blacksmiths.

Property maintenance workers, who make up about one-sixth of all railroad employees, build and repair tracks, tunnels, signals, and other railroad property. Track workers repair tracks and roadbeds. Bridge and building workers construct and repair bridges, tunnels, and other structures along the right-of-way. Signal workers install and service the railroads' vast network of signals, including highway-crossing protection devices.

The accompanying chart shows the 1976 distribution of railroad employment among the four occupational groups. Detailed information about some occupations within these groups is given elsewhere in the *Handbook*.

Training, Other Qualifications, and Advancement

Most beginning railroad workers are trained on the job by experienced employees. Training for some office and maintenance jobs is available in high schools and vocational schools. Universities and technical schools offer courses in accounting, engineering, traffic management, transportation, and other subjects that are valuable to professional and technical workers.

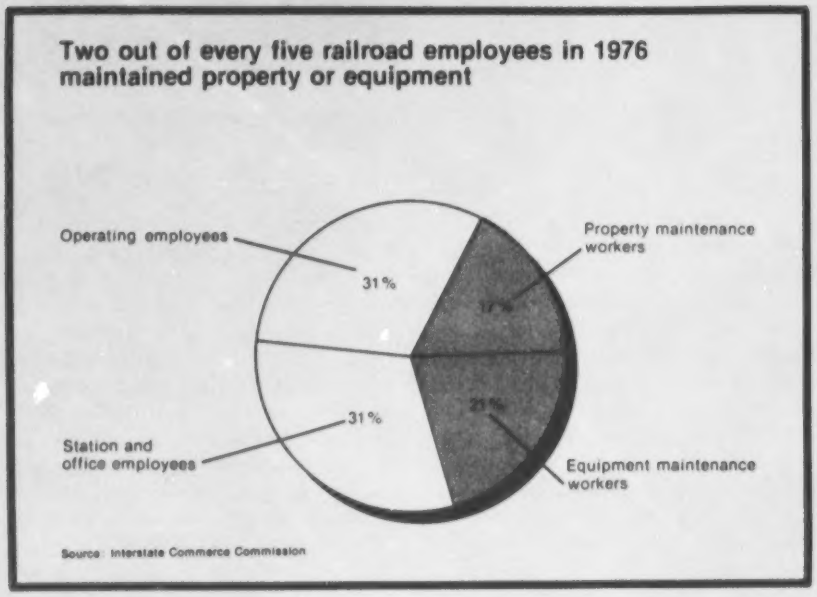
New employees in some occupations, especially those in operating service jobs such as locomotive engineer, start as "extra board" workers. They substitute for regular workers who are on vacation, ill, or absent for other reasons. They also may be called when railroad traffic increases temporarily or seasonally.

Extra board workers with enough seniority move to regular assignments as they become available. The length of time a new worker spends on the extra board varies according to the number of available openings. Some workers do not receive regular assignments for many years.

Beginners in shop trades usually are high school graduates with no previous experience, although some shop laborers and helpers are promoted to the trades. Shopworkers serve apprenticeships that last 3 to 4 years, depending on how much previous work experience the apprentice has.

Most applicants for railroad jobs must pass physical examinations. Those interested in traincrew jobs need excellent hearing and eyesight. Color-blind persons are not hired as locomotive engineers or brake operators or for any other jobs that involve interpreting railroad signals.

Railroad workers are promoted on the basis of seniority and ability. Job openings are posted on bulletin boards and workers may bid for them. The worker who is highest on the seniority list usually gets the job. To be promoted, however, workers



may have to qualify by passing written, oral, and practical tests. Advancement in train and engine jobs is along established lines. All conductors, for example, are chosen from qualified brake operators.

Besides determining advancement procedures, seniority also gives workers some choice of working conditions. A telegrapher, for instance, may have to work several years on the night shift at out-of-the-way locations before finally getting a day shift assignment near home.

Employment Outlook

The long-run decline in railroad employment is expected to continue through the mid-1980's, but at a decreasing rate. Nevertheless, thousands of job opportunities will develop each year as the industry replaces some experienced workers who retire, die, or transfer to other fields of work.

Despite an expected increase in freight traffic, railroad employment will decline as technical innovations increase worker productivity. For example, as automatic classification systems are installed in more yards, fewer yard workers will be needed to assemble and disassemble trains. The installation of wayside scanners, which identify cars electronically, will reduce the need for clerical workers.

Most people working in passenger service may eventually work for AMTRAK, the National Railroad Passenger Corporation, created in 1971 to revive train passenger service.

Earnings and Working Conditions

Nonsupervisory railroad employees averaged $6.88 an hour in 1976, about two-fifths higher than the average for all nonsupervisory workers in private industry, except farming. Earnings of railroad workers vary widely, however, depending on the occupation. For example, in 1976 average hourly earnings for locomotive engineers in passenger service were $12.71; for freight service brake operators $7.96; for railway clerks, $6.39; and for track gang members, $5.89. Regional wage differences are much less in railroading than in other industries because of nationally negotiated labor contracts.

Most railroad employees work a 5-day, 40-hour week, and receive premium pay for overtime. However, operating employees often work nights, weekends, and holidays. Extra board workers may be called to duty on short notice and at any time. Bridge and building workers, signal installers, and track workers may work away from home for days at a time.

Sources of Additional Information

Additional information about occupations in the railroad industry may be obtained from local railroad offices. For general information about the industry, write to:

Association of American Railroads, American Railroads Building, 1920 L St. NW., Washington, D.C. 20036.

OCCUPATIONS IN THE TELEPHONE INDUSTRY

Just about everyone has a telephone. Many households have two or more, and large businesses and organizations have hundreds. Some people have telephones in their cars and on their boats. A few even have portable telephones that they carry with them like briefcases. There also are thousands of public telephones on street corners and in airports, restaurants, and stores. Altogether, more than 155 million telephones were in use in the United States in 1976, and people made over 600 million local and long-distance calls every day.

To provide all this service, telephone companies employed approximately 920,000 persons in 1976. Most worked in telephone craft occupations, in clerical occupations, or as telephone operators.

The telephone industry offers steady, year-round employment in jobs requiring a variety of skills and training. Most require a high school education; some can be learned on the job. Many require particular skills that may take several years of experience, in addition to 9 months of training, to learn completely.

Telephone jobs are found in almost every community, but most telephone employees work in cities that have large concentrations of industrial and business establishments. The nerve center of every local telephone system is the central office that contains the switching equipment through which one telephone may be connected with any other telephone. When a call is made, the signals travel from the caller's telephone through wires and cables to the cable vault in the central office. Here thousands of pairs of wires, including a pair for the caller's telephone, fan out to a distributing frame where each pair is attached to switching equipment. As the number is dialed, electromechanical and electronic switching equipment make the connection automatically, and, in seconds, the caller hears the telephone ringing. Only in a few remaining switchboards and in unusual situations does an operator make the connection.

Because some customers make and receive more calls than a single telephone line can handle, a system somewhat similar to a miniature central office may be installed on the customer's premises. This system is the private branch exchange (PBX), usually found in office buildings, hotels, department stores, and other business firms.

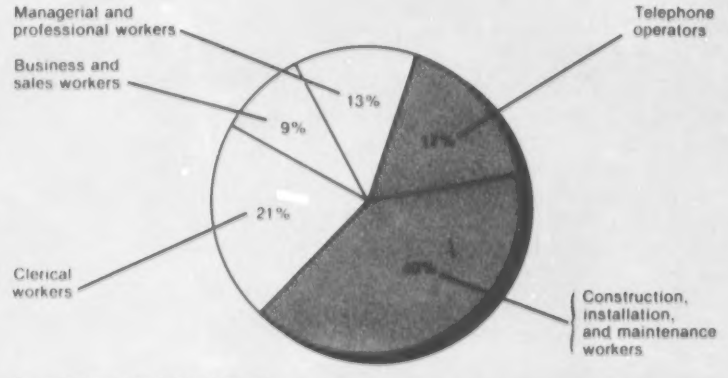
Another type of service for businesses is called CENTREX, in which incoming calls can be dialed to any extension without an operator's assistance, and outgoing and interoffice calls can be dialed by the extension users. This equipment can be located either on telephone company premises or on the customer's premises. CENTREX has replaced PBX in popularity among business and industrial users that handle a very large volume of calls. However, PBX is still more popular with smaller users.

Other communications services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephone users simultaneously; mobile radio-telephones in automobiles, boats, airplanes, and trains; and telephones equipped to answer calls automatically and to give and take messages by recordings.

Besides providing telephones and switching equipment, telephone companies build and maintain most of the vast network of cables and radio-relay systems needed for communications services, including those that join the thousands of broadcasting stations around the country. These services are leased to networks and their affiliated stations. Telephone companies also lease data and private wire services to business and government offices.

The Bell System owns more than 4 out of 5 of the Nation's telephones. Independent telephone companies own the remainder. There are approximately 1,600 independent telephone companies in the United

Telephone craft workers and operators made up more than one-half of all workers employed in the industry in 1976



Source: American Telephone and Telegraph

States. General Telephone and Electronics Corp., United Utilities, Inc., and Continental Telephone Corp., service about 2 out of every 3 telephones owned by independent companies.

Telephone Occupations

Although the telephone industry requires workers in many different occupations, telephone craft workers and operators make up more than one-half of all workers. (See accompanying chart.)

Telephone craft workers install, repair, and maintain telephones, cables, switching equipment, and message accounting systems. These workers can be grouped by the type of work they perform. Construction workers place, splice, and maintain telephone wires and cables; installers and repairers place, maintain, and repair telephones and private branch exchanges (PBX) in homes and offices and other places of business; and central office craft workers test, maintain, and repair equipment in central offices.

Operators make telephone connections; assist customers in specialized services, such as reverse-charge calls; and provide information. Detailed discussions of telephone craft occupations and telephone and PBX operators are presented elsewhere in the *Handbook*.

More than one-fifth of all telephone industry employees are clerical workers. They include stenographers, typists, bookkeepers, office machine and computer operators, keypunch operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. Clerical workers keep records of services, make up and send bills to customers, and prepare statistical and other reports.

About one-tenth of the industry's employees are professional workers. Many of these are scientific and technical personnel such as engineers and drafters. Engineers plan cable and microwave routes, central office and PBX equipment installations, new buildings, and the expansion of existing structures, and solve other engineering problems.

Traffic operator uses computer terminal to complete customer's call.

Some engineers also engage in research and development of new equipment, and persons with engineering backgrounds often advance to fill top managerial and administrative positons. Other professional and technical workers are accountants, personnel and labor relations workers, public relations specialists and publicity writers, computer systems analysts, computer programmers, and lawyers.

About 1 in every 12 of the industry's employees is a business and sales representative. These employees sell new communications services and directory advertising and handle requests for installing or discontinuing telephone service.

About 3 percent of the industry's workers maintain buildings, offices, and warehouses; operate and service motor vehicles; and do other maintenance jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other workers employed by the telephone industry are janitors, porters, and guards.

Employment Outlook

Telephone industry employment is expected to increase about as fast as the average for all industries through the mid-1980's. In addition to the jobs from employment growth, tens of thousands of openings will arise each year because of the need to replace experienced workers who retire, die, or leave their jobs for other reasons.

Employment will grow primarily because higher incomes and a larger and more mobile population will in-

crease the use of telephone service. Greater demand for transmission of computer-processed data and other information via telephone company lines also will stimulate employment growth. Laborsaving innovations, however, will keep employment from growing as rapidly as telephone service.

Employment of telephone operators is expected to decline. As the number of telephone companies charging customers for directory assistance calls increases, more people will dial numbers directly and use telephone directories to locate needed numbers, thus reducing the need for operators. Also, improved switching equipment will allow more calls to be connected without an operator's assistance, and more advanced billing systems will automatically relay billing information to computerized files that are used in preparing customer's billing statements. Technological innovations will restrict employment growth in some skilled crafts. For example, mechanical improvements, such as pole-lifting equipment and earth-boring tools, have limited the employment of line installers by increasing their efficiency.

New technology, however, is expected to increase the demand for engineering and technical personnel, especially electrical and electronic engineers and technicians, computer programmers, and systems analysts. Employment in administrative and sales occupations will rise as telephone business increases.

Earnings and Working Conditions

In 1976, earnings for nonsupervisory telephone employees averaged $6.46 an hour. In comparison, nonsupervisory workers in all private industries, except farming, averaged $4.87 an hour.

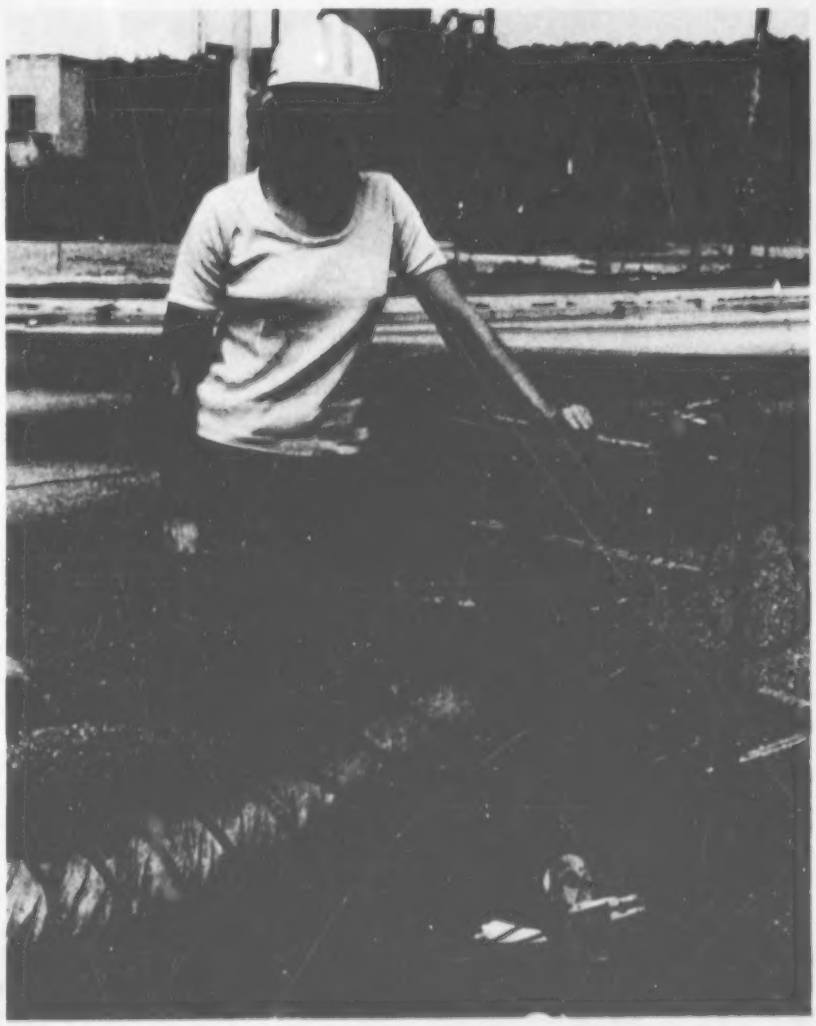
In late 1975, basic rates ranged from an average of $3.75 an hour for telephone operator trainees to $10.76 for professional and semiprofessional workers other than drafters.

A telephone employee usually starts at the minimum wage for the particular job. Advancement from the starting rate to the maximum rate generally takes 5 years, but operators and clerical employees of some companies may reach the maximum rate in 4 years.

More than two-thirds of the workers in the industry, mainly telephone operators and craft workers, are members of labor unions. The two principal unions representing workers in the telephone industry are the Communications Workers of America and the International Brotherhood of Electrical Workers, but many other employees are members of the 15 independent unions that form the Telecommunications International Union.

Union contracts govern wage rates, wage increases, and the amount of time required to advance from one step to the next for most telephone workers. The contracts also call for extra pay for work beyond the normal 8 hours a day, or 5 days a week, and for all Sunday and holiday work. Most contracts provide a pay differential for night work.

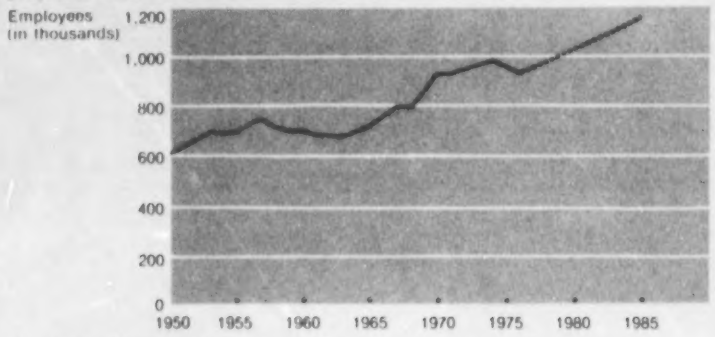
Overtime work sometimes is required, especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency call-out," which is a short-notice request to report for work during nonscheduled hours, workers are guar-



Some line installers work underground.

Although employment in the telephone industry will fluctuate due to economic cycles, moderate long-term growth is expected

Wage and salary workers in telephone communication, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

anteed a minimum period of pay at the basic hourly rate. Travel time between jobs is counted as worktime for craft workers under some contracts.

Paid vacations are granted according to length of service. Usually, contracts provide for a 1-week vacation beginning with 6 months of service; 2 weeks for 1 to 7 years; 3 weeks for 8 to 15 years; 4 weeks for 16 to 24 years; and 5 weeks for 25 years and over. Depending on locality, holidays range from 9 to 11 days a year. Most telephone workers are covered by paid sick leave plans and group insurance which usually provide sickness, accident, and death benefits and retirement and disability pensions.

The telephone industry has one of the best safety records in American industry. The number of disabling injuries has been well below the average.

Sources of Additional Information

More details about employment opportunities are available from the telephone company in your community or local offices of the unions that represent telephone workers. If no local union is listed in the telephone directory, write to:

Telecommunications International Union, P.O. Box 5462, Hamden, Conn. 06518.

International Brotherhood of Electrical Workers, 1200 15th St. NW., Washington, D.C. 20005.

United States Independent Telephone Association, 1801 K St. NW., Suite 1201, Washington, D.C. 20006.

OCCUPATIONS IN THE TRUCKING INDUSTRY

In 1976, the trucking industry employed approximately 1.2 million workers—more than the rival rail, air, and pipeline transportation industries combined. It is a major employer of persons not planning to attend college, since nearly 90 percent of its employees are freight handlers, drivers, truck maintenance personnel, or clerical workers—occupations which only require a high school education.

Nature and Location of the Industry

The trucking industry is made up of companies that sell transportation and storage services. Although many trucking companies serve only a single city and its suburbs, and others carry goods only between distant cities, most large trucking firms provide both types of service. Some firms operate one type of truck and specialize in one type of product. For example, they may carry steel rods on flat trailers or grain in open top vans. In addition, trucking companies may operate as either contract or common carriers. Contract carriers haul commodities of one or a few shippers exclusively; common carriers offer transportation services to businesses in general.

Trucking companies vary widely in size. Almost half of the industry's workers are employed by less than 10 percent of the companies. But a large proportion of companies are small, particularly those which serve a single city. Many companies are owner-operated, and the owner does the driving.

Trucking industry employees work in cities and towns of all sizes and are distributed much the same as the Nation's population.

Occupations in the Industry

About four-fifths of all trucking industry employees have blue-collar jobs, including about 620,000 truckdrivers. Other large blue-collar occupations are material handlers, mechanics, washers and lubricators, and supervisors. Most white-collar employees are clerical workers, such as secretaries and rate clerks, and administrative personnel, such as terminal managers and accountants.

The duties and training requirements of some of these occupations are described briefly in the following sections.

Truckdriving Occupations. More than half of the industry's employees are drivers. *Long-distance truckdrivers* (D.O.T. 904.883) spend nearly all their working hours driving large trucks or tractor trailers between terminals. Some drivers load and unload their trucks, but the usual practice is to have other employees do this work. *Local truckdrivers* (D.O.T. 906.883) operate trucks over short distances, usually within one city and its suburbs. They pick up goods from, and deliver goods to, trucking terminals, businesses, and homes in the area.

Clerical Occupations. About 1 out of every 8 of the industry's employees is a clerical worker. Many have general clerical jobs, such as secretary or clerk-typist, which are common to all industries. Others have specialized jobs. For example, *dispatchers* (D.O.T. 919.168) coordinate the movement of trucks and freight into and out of terminals; make up loads for specific destinations; assign drivers and develop delivery schedules; handle customers' requests for pick-up of freight, and provide information on deliveries. *Claims adjusters* (D.O.T. 241.368) handle claims for freight lost or damaged during transit. *Manifest clerks* (D.O.T. 222.488) prepare forms that list details of freight shipments. *Parts-order clerks* (D.O.T. 223.387) supply mechanics with replacement parts for trucks; they also take care of most of the

The trucking industry employed about 1.2 million workers in 1976.

Rate clerk calculates the cost for shipping each item.

clerical duties needed to maintain a truck repair shop.

Administrative and Related Occupations. More than 1 out of 15 employees is an administrator. Top executives manage companies and make policy decisions. Middle managers supervise the operation of individual departments, terminals, or warehouses. A small number of accountants and lawyers are employed by these companies. The industry also employs sales representatives to solicit freight business.

Material Handling Occupations. About 1 out of 12 employees moves freight into and out of trucks and warehouses. Much of this work is done by *material handlers* (D.O.T. 929.887) who work in groups of three or four under the direction of a dock supervisor or gang leader. Material handlers load and unload freight with the aid of handtrucks, conveyors, and other devices. Heavy items are moved by *power truck operators* (D.O.T. 922.883) and *crane operators* (D.O.T. 921.280). Gang leaders determine the order in which items will be loaded, so that the cargo is balanced and items to be unloaded first are near the truck's door. *Truckdrivers' helpers* (D.O.T. 905.887) travel with drivers to unload and pick up freight. Occasionally, helpers may do relief driving.

Truck Maintenance Occupations. About 1 out of every 20 employees takes care of the trucks. *Truck mechanics* (D.O.T. 620.281) keep trucks and trailers in good running condition. Much time is spent in preventive maintenance to assure safe operation, to check wear and damage to parts, and to reduce breakdowns. When breakdowns do occur, these workers determine the cause and make the necessary repairs. *Truck mechanic helpers* (D.O.T. 620.884) and apprentices assist experienced mechanics in inspection and repair work. *Truck lubricators* and *washers* (D.O.T. 915.887 and 919.887) clean, lubricate, and refuel trucks, change tires, and do other routine maintenance.

Much of the truck mechanic's time is spent in preventive maintenance.

Training, Other Qualifications, and Advancement

Workers in blue-collar occupations usually are hired at the unskilled level, as material handlers, truckdrivers' helpers, lubricators, and washers. No formal training is required for these jobs, but many employers prefer high school graduates. Applicants must be in good physical condition. New employees work under the guidance of experienced workers and supervisors while learning their jobs; this usually takes no more than a few weeks. As vacancies occur, workers advance to more skilled blue-collar jobs, such as power truck operator and truckdriver. The ability to do the job and length of service with the firm are the primary qualifications for promotion. Material handlers who demonstrate supervisory ability can become gang leaders or dock supervisors.

Qualifications for truckdriving jobs vary and depend on individual employers, the type of truck, and other factors. In most States, drivers must have a chauffeur's license, which is a commercial driving permit obtained from State motor vehicle departments. The U.S. Department of Transportation establishes minimum qualifications for drivers who transport goods between States. They must be at least 21 years old, be able-bodied, have good hearing, and have at least 20/40 vision with or without glasses. However, many

firms will not hire long-distance drivers under 25 years of age. Drivers also must be able to read, speak, and write English well enough to complete required reports. Drivers must have good driving records.

People interested in professional driving should take the driver-training courses offered by many high schools. A course in automotive mechanics also is helpful. Private truck-driving training schools offer another opportunity to prepare for a driving job; however, completion of such a course does not assure employment as a driver.

Most truck mechanics learn their skills informally on the job as helpers to experienced mechanics. Others complete formal apprenticeship programs that generally last 4 years and include on-the-job training and related classroom instruction. Unskilled workers, such as lubricators and washers, frequently are promoted to jobs as helpers and apprentices. However, many firms will hire inexperienced people, especially those who have completed courses in automotive mechanics, for helper or apprentice jobs.

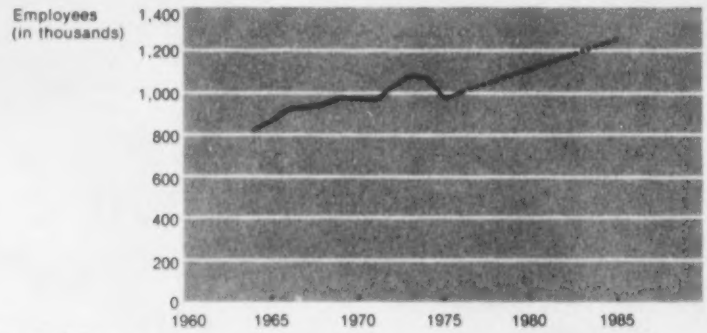
Completion of commercial courses in high school or in a private business school is usually adequate for entry into general clerical occupations such as secretary or typist. Additional on-the-job training is needed for specialized clerical occupations such as claims adjuster.

Generally, no specialized education is needed for dispatcher jobs. Openings are filled by truckdrivers, claims adjusters, or other workers who know their company's operations and are familiar with State and Federal driving regulations. Candidates may improve their qualifications by taking college or technical school courses in transportation.

Administrative and sales positions frequently are filled by college graduates who have majored in business administration, marketing, accounting, industrial relations, or transportation. Some companies have management training programs for college graduates in which trainees work for brief periods in various departments to get a broad understanding of trucking operations before they are assigned to a particular department. High school graduates may be promoted to administrative and sales positions.

Substantial long-term employment growth is expected in the trucking industry, although declines may occur during economic downturns

Wage and salary employees in trucking and trucking terminals, 1964-76 and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Employment in the trucking industry is expected to grow about as fast as the average for all industries through the mid-1980's. In addition to the large number of job openings created by employment growth, thousands more will arise as experienced workers retire, die, or transfer to other fields. The number of jobs may vary from year to year, however, because the amount of freight fluctuates with ups and downs in the economy.

Trucks carry virtually all freight for local distribution and a great deal of freight between distant cities. As the volume of freight increases with the Nation's economic growth, employment in the trucking industry will rise. More employees also will be needed to serve the many factories, warehouses, stores, and homes being built where railroad transportation is not available.

Employment will not increase as fast as the demand for trucking services because technological developments will increase output per worker. For example, more efficient freight-handling methods—such as conveyors and draglines to move freight in and out of terminals and warehouses—will increase the efficiency of material handlers. Larger trucks as well as more efficient packaging techniques will allow truckdrivers to carry more cargo.

Earnings and Working Conditions

In 1976, nonsupervisory workers in the trucking industry averaged $6.57 an hour, compared with $4.87 an hour for their counterparts in all private industry, except farming. Earnings are relatively high in the trucking industry, because highly paid drivers represent a large proportion of employment; many long-distance drivers earn more than $300 a week.

Most employees are paid an hourly rate or a weekly or monthly salary. However, truckdrivers on the longer runs generally are paid on a mileage basis while driving. For all other worktime, they are paid an hourly rate.

Working conditions vary greatly among occupations in the industry. While maneuvering large trucks in fast-moving traffic can cause tension, more comfortable seating, power steering, and air-conditioned cabs have reduced physical strain. Long-distance drivers frequently work at night and may spend time away from home; local drivers usually work during the day. Material handlers and

truckdrivers' helpers have strenuous jobs, although conveyor systems and other freight handling equipment have reduced some of the heavier lifting, making the work easier and safer. Truck mechanics and other maintenance personnel may have to work in awkward or cramped positions while servicing vehicles, and frequently get dirty because of the grease and oil on the trucks. In addition, most maintenance shops are hot in summer and drafty in the winter. Mechanics occasionally make repairs outdoors when a truck breaks down on the road.

Many large organizations operate around the clock and require some material handling and maintenance personnel to work evenings, nights, and weekends.

A large number of trucking industry employees are members of the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America (Ind).

Sources of Additional Information

For general information about career opportunities in the trucking industry, write to:

American Trucking Associations, Inc., 1616 P St. NW., Washington, D.C. 20036.

Information about specific jobs may be available from the personnel departments of local trucking companies or the local office of your State employment service.

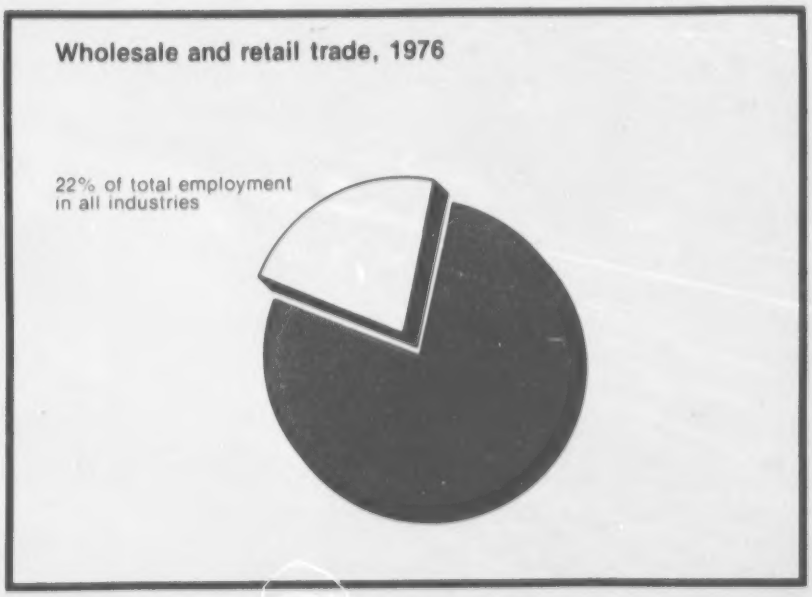
WHOLESALE AND RETAIL TRADE

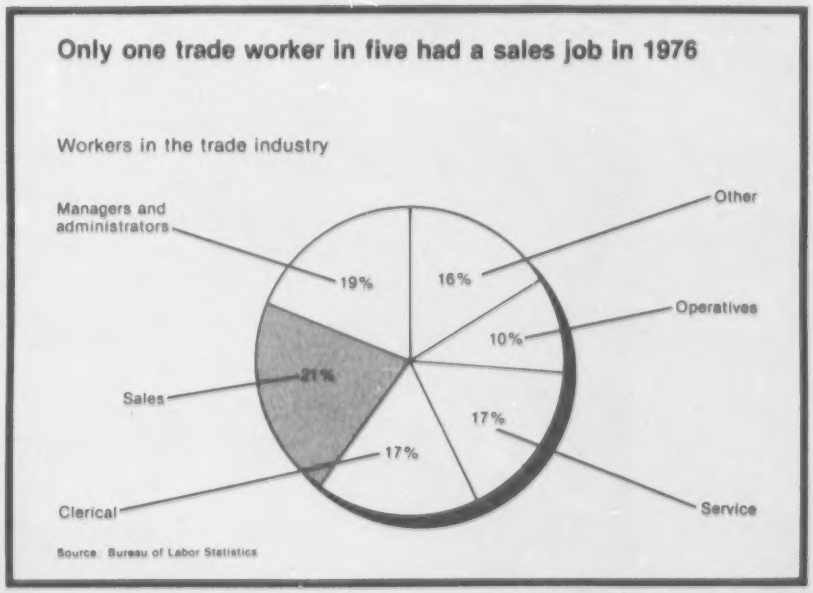
Wholesaling and retailing are the final stages in the transfer of goods from producers to consumers. Wholesalers assemble goods in large lots for distribution to retail stores, industrial firms, and institutions such as schools and hospitals. Retailers sell goods directly to consumers in a variety of ways—in stores, by mail, or through door-to-door selling. A list of the items sold by wholesale and retail businesses would include almost every item produced by industry—automobiles, clothing, food, furniture, and countless others.

In 1976, about 17.7 million people (not counting an estimated 1.7 million who were self-employed persons or unpaid family workers) worked in wholesale and retail trade. The largest number of workers—13.4 million or about three-fourths of them—were employed in retail trade. The majority of these workers held jobs in department stores, food stores, and restaurants and other eating places. About 4.3 million people worked in wholesale trade.

Workers with a wide range of education, training, and skills hold jobs in wholesale and retail trade. As shown in the accompanying tabulation, almost 3 out of 5 workers in these industry divisions are white-collar workers (professional, managerial, clerical, and sales). Sales workers, the largest single group, make up more than one-fifth of total industry employment. Managers and proprietors, the second largest group, constitute nearly one-fifth of the industry's work force. Many managers and proprietors own and operate small wholesale houses or retail outlets such as food stores and gas stations. Clerical workers make up over one-sixth of the work force; many hold jobs as cashiers, especially in supermarkets and other food stores. Important clerical occupations in retail trade also include secretaries, typists, office machine operators, bookkeepers, and accounting clerks. Large numbers of shipping and receiving clerks work in both wholesale and retail trade.

Blue-collar workers (craftworkers, operatives, and laborers) constitute nearly one-fourth of the industry's jobholders. Many work as mechanics and repairers, gas station attendants,





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drivers and delivery workers, meatcutters, and materials handlers. Most mechanics work for motor vehicle dealers and gasoline service stations. A large number of meatcutters work in wholesale grocery establishments and in supermarkets and other food stores.

Service workers, employed mostly in retail trade, constitute about 1 out of 6 workers in the industry. Food service workers, such as waitresses and cooks, make up by far the largest concentration of service workers. Other large groups of service workers are janitors, cleaners, and guards.

Employment in wholesale and retail trade is expected to increase by about the same rate as the average for all industries throug mid-1980's as sales rise in response to growth in population and income. Due to laborsaving innovations, however, employment is not expected to grow as fast as sales. The use of computers for inventory control and billing, for example, may limit the need for additional clerical workers. Improved methods of handling and storing merchandise will limit the demand for laborers.

The statements that follow discuss job opportunities in restaurants and food stores. More detailed information about occupations that cut across many industries appears elsewhere in the *Handbook*.

OCCUPATIONS IN THE RESTAURANT INDUSTRY

In 1976, the restaurant industry was the third largest industry in the country, employing 3.7 million people in establishments ranging from roadside diners to luxurious restaurants. The type of food and service a restaurant offers varies with its size and location, as well as with the kind of customer it seeks to attract. Fast-food restaurants and cafeterias in suburban shopping centers emphasize rapid service and inexpensive meals. Steak houses and pizza places consider the quality of their specialty most important. Some restaurants cater to customers who wish to eat a leisurely meal in elegant surroundings and their menus often include unusual dishes or "specialties of the house."

Most restaurants are small and have fewer than 10 paid employees; some of these are operated by their owners. An increasing proportion of restaurants, however, are part of a chain operation.

Restaurant jobs are found almost everywhere. Although employment is concentrated in the States with the largest populations and particularly in large cities, even very small communities have sandwich shops and roadside diners.

Restaurant Workers

About three-fourths of all restaurant employees prepare and serve food, and keep cooking and eating areas clean. Waiters and waitresses, and cooks and chefs make up the two largest groups of workers. Others are counter workers, who serve food in cafeterias and fast-food restaurants; bartenders, who mix and serve drinks; dining room attendants, who clear tables, carry dirty dishes back to the kitchen, and sometimes set tables; dishwashers, who wash dishes and help keep the kitchen clean; pantry workers, who prepare salads, sandwiches, and certain other dishes; and janitors and porters, who dispose of trash, sweep and mop floors, and keep the restaurant clean. Some of these workers operate mechanical equipment such as dishwashers, floor polishers, and vegetable slicers. (Detailed information on cooks and chefs, waiters and waitresses, bartenders, food counter workers, and dining room attendants and dishwashers is given elsewhere in the *Handbook*.)

Another large group of restaurant workers—about one-seventh of the total—are managers and proprietors. Many are owners and operators of small restaurants and, in addition to acting as managers, may cook and do other work. Some are salaried employees who manage restaurants for others.

All other restaurant workers combined account for about one-sixth of total industry employment. Most are clerical workers—cashiers who receive payments and make change for customers; food checkers who total the cost of items selected by cafeteria customers; and bookkeepers, typists, and other office workers. A few restaurants employ dietitians to plan menus, supervise food preparation, and enforce sanitary regulations. Restaurant chains and some large restaurants employ mechanics and other maintenance workers, accountants, advertising or public relations directors, personnel workers, and musicians and other entertainers.

With 3.7 million employees in 1976, restaurants made up the third largest industry in the country.

Training, Other Qualifications, and Advancement

The skills and experience needed for restaurant work vary from one occupation to another. Many jobs require no special training or experience, while others require some college or managerial experience. Requirements also vary from one restaurant to another; large or expensive restaurants usually have higher educational and experience standards than diners or small restaurants.

Persons who have less than a high school education and no previous experience often qualify for jobs as kitchen workers, dishwashers, or dining room attendants. Although a high school education is not mandatory, some restaurants hire only those with a diploma and some hire only experienced waiters and waitresses, cooks, and bartenders. Special training or many years of experience or both usually are required for chefs' positions.

Newly hired restaurant workers generally are trained on the job. Kitchen workers, for example, may be taught to operate a lettuce-shredder and make salads. Waiters and waitresses are taught to set tables, take orders from customers, and serve food in a courteous and efficient manner. In many restaurants, new employees receive their training under the close supervision of an experienced employee or the manager. Large restaurants and some chain restaurant operations may have more formal programs that often include several days of training sessions for beginners. Some employers, such as fast-food restaurants, use instructional booklets and audio-visual aids to train new employees.

Many public and private high schools offer vocational courses for persons interested in restaurant training. Usually included are food preparation, catering, restaurant management, and other related subjects. Similar training programs are available for a variety of occupations through hotel and motel associations, restaurant associations and trade unions, technical schools (junior and community colleges, and 4-year colleges. Programs range in length from a few months to 2 years or more. The Armed Forces are another good source of training and experience in food service work.

When hiring food service workers such as waiters and waitresses and cooks and chefs, employers look for applicants who have good health and physical stamina because the work is often tiring. Because of the need to work closely with others and under considerable pressure, applicants should be able to remain calm under stress. In addition, a neat appearance and a pleasant manner are important for bartenders, waiters and waitresses and other employees who meet the public. Advancement opportunities in restaurants vary among the occupations. They are best for cooks who may advance to chef, or supervisory or management positions, particularly in hotels, clubs, or larger, more elegant restaurants. Experience as maitre d'hotel may lead to a position as director of food and beverage services in a large chain organization. For most other restaurant occupations, however, advancement is limited, principally because of the small size of most food service establishments. For some occupations, such as food counter workers in fast-food restaurants, advancement is further limited because most workers remain employed for only a short time.

Although many restaurant managers obtain their positions through hard work and advancement within a restaurant's staff, it is becoming increasingly important for restaurant managers to have a college degree in hotel, restaurant or institutional management. Graduates employed by hotels and restaurants usually go through a management training program before being given much supervisory and administrative responsibility. They often are hired as assistant managers and subsequently advance to manager. From there it is possible, particularly in the large restaurant chains, to advance to a top management position. Those with the necessary capital may open their own eating establishments.

Employment Outlook

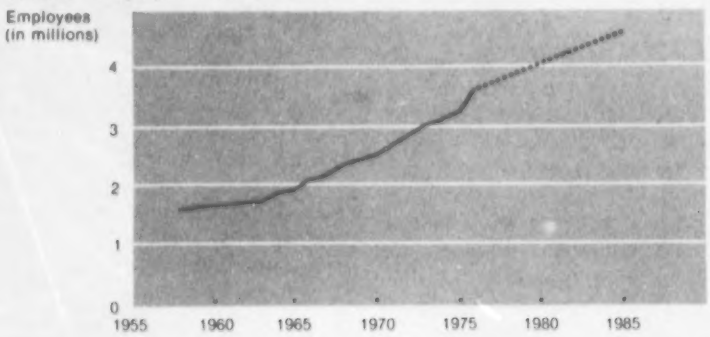
Employment in the restaurant industry is expected to increase faster than the average for all industries through the mid-1980's. In addition to the openings arising from employment growth, thousands of openings are expected each year due to turnover—the need to replace experienced employees who find other jobs or who retire, die, or stop working for other reasons. Turnover is particularly high among part-time workers, many of whom are students. As a result, there are plenty of jobs available in this industry for interested persons, including those with limited skills.

Most openings will be for waiters and waitresses and cooks—both because of their high replacement needs and because these workers make up a very large proportion of all restaurant employees. High school students make up a large percentage of the workers in fast-food

Employment in restaurants is expected to increase faster than the average for all industries.

Continued rapid employment growth resulting from population growth, rising personal incomes, and more leisure time is expected in the restaurant industry

Wage and salary workers in eating and drinking places, 1958-76 and projected 1985



restaurants. Employment opportunities also are expected to be favorable for food counter workers. The number of openings in clerical jobs, such as cashier, will be relatively small. A few openings will occur in specialized positions, such as food manager and dietitian.

Population growth, rising personal incomes, and more leisure time will contribute to a growing demand for restaurant services. Also, as an increasing number of wives work, more and more families may find dining out a welcome convenience. Fast-food and other multiunit restaurants constitute the fastest growing segment of this industry. Many food service workers will be needed to serve the increasing number of customers served by these restaurants. Increasing worker productivity, however, will prevent employment from growing as rapidly as demand for restaurant services. Restaurants have become more efficient as fast-food service counters have become more popular, and as managers have centralized the purchase of food supplies, introduced self-service, and used precut meats and modern equipment. Many restaurants now use frozen entrees in individual portions, which require less time and skill to prepare than fresh foods.

Earnings and Working Conditions

Earnings of restaurant workers depend on the location, size, type, and degree of unionization of the restaurant in which they work. Also, workers in some occupations receive tips in addition to their wages.

In 1976, nonsupervisory workers in the restaurant industry averaged $2.50 an hour (excluding tips). Data from union contracts covering eating and drinking places in several large cities indicate the following range of hourly earnings for individual occupations:

	Hourly rate range [1]
Chefs	$3.11–6.01
Bartenders	2.85–5.33
Cooks	2.81–5.19
Pantry workers	2.08–4.38
Kitchen helpers	2.12–4.14
Assistant cooks	2.02–4.05
Checkers	2.25–3.94
Food counter workers	1.67–3.79
Porters	2.24–3.75
Dishwashers	1.94–3.75
Cashiers	2.24–3.58
Dining room attendants	1.26–3.41
Waiters and waitresses	1.25–2.95

[1] Tips not included.

Salaries of managerial workers differ widely because of differences in duties and responsibilities. Many college graduates who had specialized training in restaurant management received starting salaries ranging from $10,000 to $12,000 annually in 1976. Managerial trainees without this background often started at lower salaries. Many experienced managers earned between $15,000 and $30,000 a year.

In addition to wages, restaurant employees usually get at least one free meal a day, and often are provided with uniforms. Waiters, waitresses, and bartenders also may receive tips.

Most full-time restaurant employees work 30 to 48 hours a week; scheduled hours may include evenings, holidays, and weekends. Some work on split shifts, which means they are on duty for several hours during one meal, take some time off, and then return to work for the next busy period.

Many restaurants have convenient work areas, and are furnished with the latest equipment and laborsaving devices. Others, particularly small restaurants, offer less desirable working conditions. In all restaurants, workers may stand much of the time, have to lift heavy trays and pots, or work near hot ovens or steam tables. Work hazards include the possibility of burns; sprains from lifting heavy trays and other items; and slips and falls on wet floors.

The principal union in the restaurant industry is the Hotel and Restaurant Employees and Bartenders International Union (AFL-CIO). The proportion of workers covered by union contracts varies greatly from city to city.

Sources of Additional Information

For additional information about careers in the restaurant industry, write to:

National Institute for the Foodservice Industry, 120 South Riverside Plaza, Chicago, Ill. 60606.

The Educational Institute, American Hotel and Motel Association, 1407 S. Harrison

Rd., Michigan State University, East Lansing, Mich. 48823.

Information on vocational education courses for restaurant work may be obtained from the local director of vocational education, the superintendent of schools in the local community, or the State director of vocational education in the department of education in the State capital.

OCCUPATIONS IN RETAIL FOODSTORES

In the United States, grocery stores and supermarkets are as common as baseballs in summer, and almost always near at hand. The local foodstore is a small part of a large industry—the retail foodstore industry—which employs about 2.3 million workers.

Jobs in foodstores vary, and workers range in education and training from high school dropouts to college-educated managerial and marketing professionals. Jobs in foodstores are especially attractive because employers often provide training and because the opportunities for promotion are good. The large number of opportunities for part-time employment may be of special interest to homemakers and students who do not want full-time jobs. In fact, part-time workers account for over 50 percent of the work force in supermarkets, according to a recent survey.

Nature of the Work

The industry pioneered self-service marketing techniques that permit customers to select items from shelves and refrigerated display cases and bring them to checkout stands. Self-service methods reduce the number of employees needed. Therefore the cost of operating a store is lower. As a result, food sold in large self-service foodstores, or supermarkets, generally is less expensive than food sold in small stores.

There are three basic types of foodstores: supermarkets, which sell many items; small grocery stores, including convenience stores; and specialty food stores, which emphasize a particular type of food or service.

Supermarkets are large, self-service grocery stores that may sell meat; canned, frozen, or fresh vegetables; dairy products; delicatessen; baked foods; and other items. Many now have large specialty food and nonfood departments and offer a wide range of services. Pharmacies, liquor departments, film processing, check cashing, money orders, and catering services are common.

Supermarkets and small grocery stores account for the overwhelming majority of establishments and employees in the industry. While a supermarket generally employs between 25 and 75 persons, the average number of paid employees in all retail food stores is between 10 and 15. Because prices generally are lower than at any other type of foodstore, supermarkets attract customers who make many purchases. When only a loaf of bread or a quart of milk is needed, however, consumers may prefer a nearby neighborhood grocery store or a specialty foodstore.

Small neighborhood grocery stores are the most numerous of all foodstores. Besides a small selection of popular food items, they may feature ethnic foods. Usually, owners personally manage these stores and only employ additional help as needed. Few owners operate more than one store.

Convenience stores are small grocery stores that specialize in a rather limited selection of items that customers might want in a hurry. Although many items are priced higher than in supermarkets, customers are attracted by longer hours, fast service, and convenient location. As a result, supermarkets have lost some business to convenience stores in recent years.

Specialty food stores operate in much the same manner as small neighborhood grocery stores. However, they may feature only one type of food, such as dietetic or health food, bakery products, dairy products, or candy. Most are small and usually are operated by the owner and a few clerks. In recent years, as supermarkets have expanded their selection of goods and services, they have taken considerable business away from specialty stores.

Occupations in the Industry

About 40 percent of foodstore workers are either clerical employees—stock clerks, cashiers, and bookkeepers—or semiskilled workers—meatcutters, meatwrappers, fruit and vegetable processors, and packers. Laborers, including stock and material handlers, order fillers, and warehouse selectors, make up about 25 percent of employment. Managers and administrators including buyers make up an additional 20 percent of total employment. The remaining 15 percent are accountants, personnel and labor relations workers, route drivers, truckdrivers, cleaning, food, and other service workers, sales workers, bakers, mechanics, and others. (Separate statements on many of these occupations found in retail foodstores, as well as in other industries, appear elsewhere in the *Handbook*.)

Retail foodstore managers (D.O.T. 185.168) coordinate store operations. They often plan work schedules, deal with advertising and merchandising, and always are concerned with customer relations. Other major responsibilities include store security, personnel matters, expense control, and planning possible competitive maneuvers.

Clerks in supermarkets usually are called stock, grocery, or produce clerks. In the grocery department, stock clerks keep shelves filled with merchandise. For example, they may count the cans of soup on the shelves and in the stockroom and decide how much to reorder from the warehouse. Since storage space is limited, the order should include only as much as might be sold before another delivery from the warehouse will be made.

Stock clerks frequently rearrange food to create an attractive display. They help customers find what they want and perform general clean-up duties. In supermarkets, stock clerks occasionally may operate cash registers or bag groceries.

Produce clerks maintain the displays of fruits and vegetables. Be-

Produce clerk arranges food to create an attractive display.

cause fruits and vegetables are perishable, clerks use special techniques to keep the stock attractive. Fruits and vegetables are rotated so that goods received in the store first are sold first. Lettuce and other greens are moistened and chilled to preserve crispness. In addition to caring for the displays, produce clerks help unload delivery trucks, keep the produce department clean, answer customers' questions, and weigh and bag produce.

In large stores that have bakery and delicatessen departments, other clerks may work behind counters selling cakes or lunchmeats.

Meatcutters and wrappers order and prepare meats for sale. Since meat often is delivered to the store in large pieces, meatcutters use saws and knives to cut the large pieces into roasts, steaks, stew meats, and other meal-size portions. After the fat is cut away and bone chips are removed, the meat is placed in plastic trays ready to be wrapped.

Meatwrappers use a machine to wrap the package of meat in clear plastic. Then, the wrappers weigh the packages and attach labels the weighing machine has printed which identify the type of meat, weight, price per pound, and total price for each package.

At the checkout counter, cashiers ring up the price of each item on the cash register, add sales tax, receive checks or money, make change, and bag purchases. An increasing number of stores have computerized checkout systems that automatically perform some of these functions in addition to others.

Cashiers, who are often the only employees customers meet, must be pleasant, courteous, fast, and accurate. Cashiers must detect price changes on cans and boxes. For produce and other items that change price frequently, price lists may be used. When not serving customers, cashiers clean counters and restock small convenience items, such as razor blades and candy, displayed near the checkout counter.

Many supermarkets also employ workers to bag and carry groceries from the checkout counter to customers' cars. Cleaning and other service workers polish floors, clean windows, sanitize meat preparation rooms, and do other housekeeping jobs. The store manager observes the activities of each department, corrects problems as they arise, and is responsible for all activities and the store's success.

The central administrative offices of supermarket chains employ accountants, bookkeepers, buyers, personnel specialists, computer specialists, clerks, secretaries, and other office workers. Chain stores also employ many truckdrivers, stock clerks, and laborers in warehouses.

Training, Other Qualifications, and Advancement

In a large supermarket, a new employee usually begins as a trainee in one of the following occupations: cashier, stock clerk, produce clerk, meatwrapper, or meatcutter. In smaller stores, however, new employees usually are trained as combination cashiers-clerks.

When hiring trainees, employers look for high school graduates who are good at arithmetic and who make a neat appearance. An outgoing personality and the ability to get along with people also are important, particularly for cashiers. Applicants who have less than a high school education may be hired if they qualify in other respects.

New workers learn their jobs mostly by helping and observing experienced employees. A few years may be needed to qualify as a skilled meatcutter, but cashiers and produce clerks generally can learn their jobs in several months. Jobs as stock clerks and meatwrappers can be learned in even less time.

Before being assigned to a store, cashier trainees may attend a school operated by a supermarket chain. These short-term courses, which emphasize rapid and accurate operation of cash registers and computer assisted checkout systems, include instructions for treating customers courteously and for handling complaints. Trainees who pass the examination are assigned to a store to finish their training; those who fail may be hired for other jobs, such as stock or produce clerk.

Some stores have meatcutter apprenticeship programs, which generally last 2 to 3 years, and include classroom instruction as well as on-the-job training.

Foodstores provide ambitious employees with excellent opportunities for advancement. In supermarkets, stock clerks frequently move up to better paying jobs as head clerks or

grocery department managers. Produce clerks may advance to jobs as produce managers, produce buyers, or produce supervisors of several stores. Meatwrappers can learn to be cutters, and then advance to meat department managers. Cashiers and department managers may be promoted to assistant managers and, eventually, managers of a supermarket. Advancement in small foodstores usually is limited, but employees may get all-round experience to start their own small businesses.

Many large firms have systematic training programs for manager trainees. Several years of experience generally are required before one becomes a store manager. Some attend a college or a training school or take special correspondence courses, often paid for by the company.

Some supermarket employees and managers advance to administrative jobs in their company's central offices. They may specialize in personnel, labor relations, buying, merchandising, advertising, consumer affairs, or research, or may become dairy, meat, delicatessen, produce, grocery, or nonfood specialists. Many of these jobs may require college training.

In cooperation with the Food Marketing Institute, Cornell University offers about 20 home study courses in management for food industry employees who wish to improve their chances for advancement. All employees are eligible to take these courses. Included are courses on food distribution, food warehousing and transportation, checkout management, store security, accounting, economics of food retailing, and others.

Several universities offer bachelor's, master's, and doctoral programs in food distribution. These curriculums include special courses related to the retail food store industry in addition to general courses in management, marketing, finance, business, law, accounting, economics, and other disciplines. A number of other colleges, junior colleges, and technical institutes offer programs, courses, and workshops in this field. As the industry becomes more complex, firms may increasingly seek persons with formal training.

A person graduating from a food management curriculum with a bachelor's degree generally enters a store management trainee program or a sales position with a supplier. A graduate with an advanced degree generally enters a research or planning position with a firm.

Employment Outlook

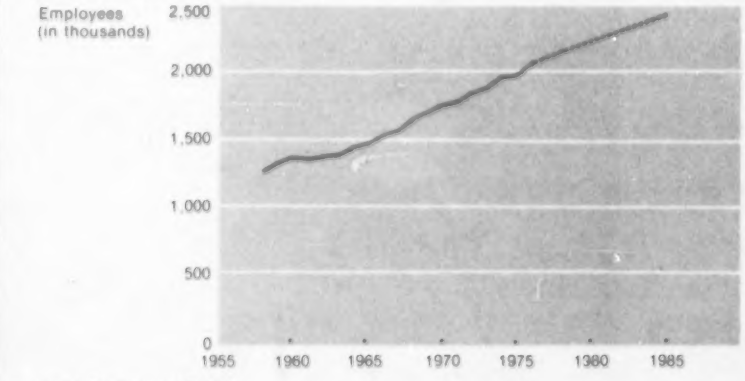
The outlook for jobs in the foodstore industry is good. Employment through the mid-1980's is expected to grow about as fast as the average for all industries. Large supermarkets and small convenience stores are expected to grow faster than other types of stores. In addition to new jobs created by growth, many openings will occur every year because of death, retirements, and other separations from the labor force. Relatively high turnover among nonmanagerial workers will continue to create many openings.

As population increases, more food will have to be distributed; this will increase foodstore sales and employment. However, employment is not expected to increase as rapidly as foodstore sales because technological innovations will increase employee productivity. For example, computer assisted checkout systems now are being used in some stores as replacements for cash registers. An optical or magnetic scanner transmits the code number (Universal Product Code—UPC) of each purchase to a computer that is programmed to record a description and the price of the item, add the tax, and print out a receipt. The computer can improve warehouse productivity by keeping track of the store's inventory and placing orders with the warehouse when needed. The development of scales for weighing and simultaneously marking meat and produce with UPC should assist the diffusion of the system. However, the high cost of electronic registers and tomputers and controversy among labor, consumer, and industry groups may slow adoption of the system. Another innovation likely to affect future employment growth is central cutting and packaging of meat and poultry. As these practices becomes more widespread, growth may be slowed for many workers, including cashiers and other clerks, meatcutters, meatwrappers, and material handlers. Overall, however, employment is expected to rise and many workers will be hired as additional supermarkets are built to keep up with the development of new communities.

Persons with college backgrounds in business administration, marketing, and related disciplines, and particularly graduates of food industry

Employment in retail food stores has grown, slowly but steadily, even during economic downturns

Wage and salary workers in retail food stores, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

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management curriculums, are expected to have the best opportunities for managerial, sales, research, planning, and other professional positons.

The outlook for part-time jobs as cashiers and stock clerks is very good. Large numbers of foodstore employees are students who are supplementing their income while attending school. After completing school, many leave for jobs in other industries. Other part-time employees also may work only for short periods. As a result, there are many part-time job opportunities that frequently can lead to full-time jobs.

Earnings and Working Conditions

Earnings of nonsupervisory workers in foodstores are among the highest in retail trade. In 1976, they averaged $4.31 an hour, compared with $3.55 an hour for nonsupervisory workers in retail stores as a whole.

Earnings vary considerably by occupation. Based on a 1975 Bureau of Labor Statistics Survey of grocery stores, average hourly wages for all workers were $5.19; head cashiers, $5.78; other full-time cashiers, $5.32; part-time cashiers, $4.31; baggers, $2.87; head grocery clerks, $6.13; other full-time grocery clerks, $5.33; part-time grocery clerks, $4.40; head meatcutters $7.11; first meatcutters, $6.73; journey level meatcutters, $6.50; meat wrappers, $5.06; head dairy clerks, $5.59; head produce clerks, $6.13; other full-time produce clerks, $5.21; and miscellaneous full-time day stockers, $5.09.

Earnings tend to be highest in large stores in metropolitan areas; they are highest in the North Central region and the West and lowest in the South. Employees generally receive health insurance, annual and sick leave, pension benefits, and other benefits usually available to workers in other industries.

Based on limited information, management and sales trainees generally earn starting salaries in excess of $10,000 a year. Experienced managers may earn considerably more than this. As is the case with other retail foodstore employees, managerial salaries usually are highest in large stores in metropolitan areas. Research and planning positons generally pay considerably more than management or sales trainee jobs.

Almost all foodstore employees must be able to stand for several hours at a time. Stock clerks must be capable of lifting cases of merchandise which weigh up to 50 pounds, and meatcutters must be careful when handling knives and using machinery, such as electric saws. Because they frequently work in refrigerated rooms, meatcutters also must be able to tolerate low temperatures (35 to 50 degrees fahrenheit). The frequency and severity of injuries in retail foodstores have been considerably higher than the average for all wholesale and retail trade.

Managers may work long hours, often staying after regular store hours to check work schedules, plan merchandising strategy, take inventory, or do paperwork. Successful store operation often depends on the manager's ability to delegate responsibility to assistants who run the store in his or her absence and to be responsive to customers' needs.

Many foodstore employees are union members. Employees in the meat department may be represented by the Amalgamated Meat Cutters and Butcher Workmen of North America. Other employees in the store may belong to the Retail Clerks International Association; some may belong to the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America (Ind.), or the Retail, Wholesale, and Department Store Union.

Sources of Additional Information

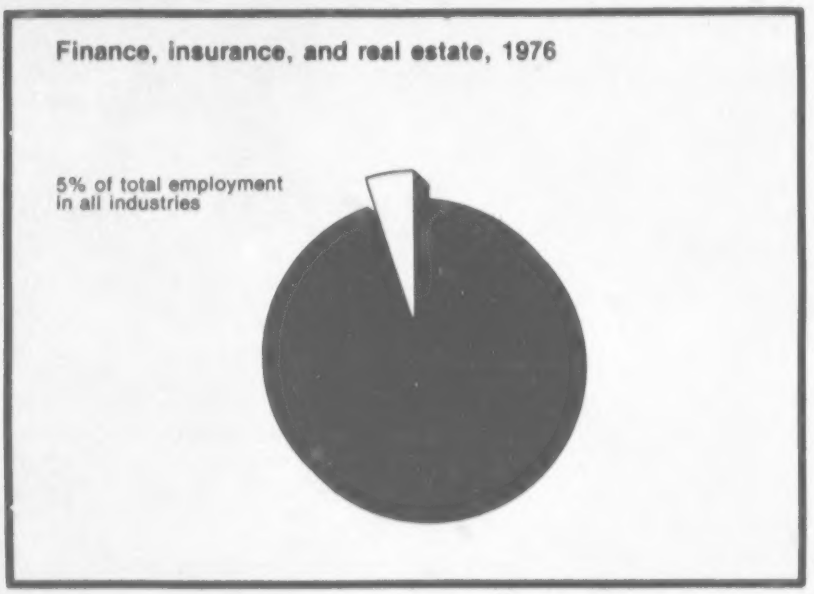
Details about employment opportunities are available from local foodstores and the local office of the State employment service. For additional information on some specific occupations in the industry, see separate statements elsewhere in the *Handbook*.

For additional information on careers in the retail foodstore industry, write to:

National Association of Retail Grocers, P.O. Box 17412, Washington, D.C. 20041.

FINANCE, INSURANCE, AND REAL ESTATE

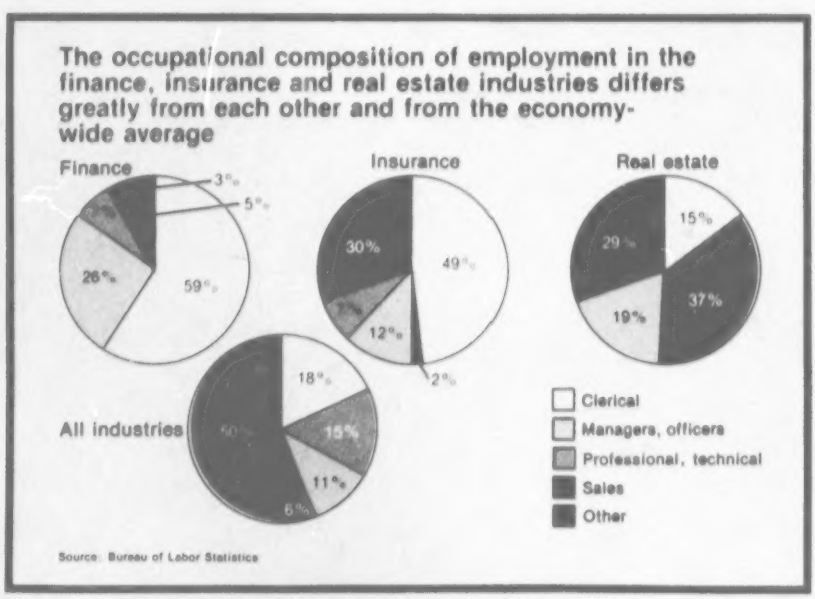
Nearly every individual and organization uses services that the finance, insurance, and real estate industry provides. Financial institutions—banks, savings and loan companies, consumer credit organizations, and others—offer services ranging from checking and savings accounts to the handling of stock and bond transactions. Insurance companies provide protection against losses caused by fire, accident, sickness, and death. Real estate firms serve as agents in the sale or rental of buildings and property, and often manage large offices and apartments.



In 1976, more than 4.3 million persons worked in the field of finance, insurance, and real estate. Finance alone employed close to 2 million persons; another 1.5 million worked in the insurance industry. The remainder, nearly 1 million, held jobs in real estate.

The overwhelming majority of these jobs are white collar. Clerical workers alone make up a large percentage of total employment. Many clerical workers have jobs that are unique to particular industries, such as bank tellers in financial institutions and claim representatives in insurance companies. Other large clerical occupations include secretary, typist, bookkeeper, and office machine operator—jobs found in nearly all industries. Sales workers also constitute a sizable portion of the work force. Most of these are insurance and real estate agents and brokers. A relatively small number of sales workers sell stocks and bonds.

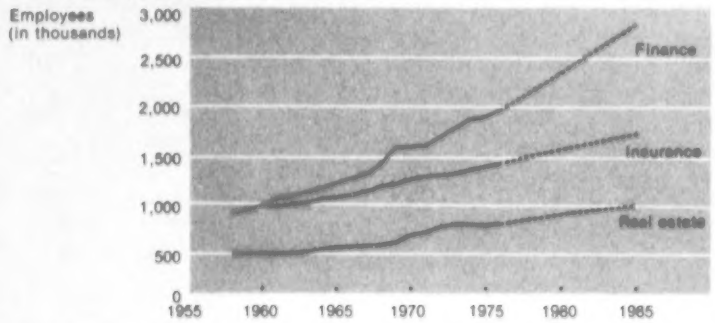
Managers and officials—bank officers, office managers, and others—constitute yet another important component of employment, while professional and technical workers—such as accountants, lawyers, computer specialists, and financial analysts—account for a much smaller share.



The accompanying chart illustrates the differences in the occupational composition of the finance, insurance, and real estate industries in 1976. In all three, professional and technical employees made up a very small share of the total, while the

Employment in finance, insurance, and real estate has grown steadily, almost unaffected by economic fluctuations

Wage and salary workers in finance, insurance, and real estate, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

proportion of managers exceeded the average for the entire economy.

Employment of sales workers, however, differed greatly among the three industries. In real estate, for example, they formed the largest single category, accounting for 40 percent of total employment. This proportion was more than 6 times the average for the economy as a whole. Insurance companies employed a slightly lower, though still very large, share of sales workers. In finance, however, sales workers made up a much smaller part of total employment.

The situation for clerical occupations was the reverse of that for sales personnel. A relatively small proportion of the workforce in real estate consisted of clerical workers; in finance and insurance, the proportion was much higher—about 50 percent.

In the future, population, business activity, and personal incomes all are expected to rise, creating a need to expand both the types of services offered and the number of establishments engaged in finance, insurance, and real estate. The three industries are expected to grow at different rates, however, as shown in the accompanying chart.

Between 1976 and 1985, employment in both finance and real estate is expected to grow faster than the average for all industries, while employment growth in insurance should be about as fast as the average. As the chart indicates, finance will grow about twice as fast as insurance, with real estate expanding at a more moderate pace.

Occupational growth rates also will vary, principally as a result of changes in technology or ways of doing business. For example, the increasing use of data processing should continue to lessen the demand for workers in routine clerical and recordkeeping functions while spurring demand for workers in computer occupations.

OCCUPATIONS IN THE BANKING INDUSTRY

Banks have been described as "department stores of finance" because they offer a variety of services ranging from individual checking accounts to letters of credit for financing world trade. Banks safeguard money and valuables; administer trusts and personal estates; and lend money to business, educational, religious, and other organizations. They lend money to individuals to purchase homes, automobiles, and household items, and to cover unexpected financial needs. Banks continually adapt their services to meet their customers' needs. In recent years, for example, they have offered revolving credit plans, charge cards, accounting and billing services, and money management counseling.

Banks and Their Workers

Banks employed approximately 1.2 million workers in 1976. Most bank employees work in commercial banks, which offer a wide variety of services. Others work in mutual savings banks, which offer more limited services—mainly savings deposit accounts, mortgage loans, safe-deposit rentals, trust management, money orders, travelers' checks, and passbook loans. Still others work in the 12 Federal Reserve Banks (or "bankers' banks") and their 24 branches as well as in foreign exchange firms, clearing house associations (where banks exchange checks and other paper), check cashing agencies, and other related organizations. In addition, nearly 500,000 people in 1976 performed similar work in savings and loan associations, credit unions, mortgage brokerage firms, and other nonbank credit agencies.

In 1976, commercial banks processed about 25 billion checks and handled an enormous amount of paperwork. Clerical workers accounted for nearly two-thirds of all bank employees. Many tellers or clerks process the thousands of deposit slips, checks, and other documents that banks handle daily. Banks also employ many secretaries, stenographers, typists, telephone operators, and receptionists.

About 25 billion checks are processed yearly.

Bank officers and managers constitute a large portion of employment in the banking industry. Approximately 1 out of 4 employees is an officer—a president, vice president, treasurer, comptroller, branch manager, loan officer, personnel officer, or other official. Professional and technical occupations, which make up a smaller segment of employment, include accountants, lawyers, labor relations workers, computer programmers and systems analysts, economists and public relations specialists. Banks, like other institutions, also employ guards, elevator operators, and other service workers.

Three large occupational categories in banking—officers and managers, tellers, and clerks—are described in separate statements elsewhere in the *Handbook*.

Places of Employment

In 1976, there were over 15,000 commercial and mutual savings banks in the United States. (Individual branches numbered approximately 50,000, but hiring usually takes place only at the main offices.) Bank employment is concentrated in a relatively small number of very large banks. In 1976, for example, almost two-thirds of all commercial bank employees worked in the Nation's 800 largest commercial banks; less than 6 percent were employed by the 6,000 smallest commercial banks.

Most bank employees work in heavily populated States, such as New York, California, Illinois, Pennsylvania, and Texas. New York City, the financial capital of the Nation, has far more bank workers than any other city.

Training and Advancement

Professional and managerial bank workers usually have completed college; most tellers and clerks have fin-

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Bank officers and managers account for about 1 out of 4 bank employees.

ished high school; guards and building service personnel may have less than a high school education.

Most new employees receive some form of in-service bank training. Banks also provide other opportunities for workers to broaden their knowledge and skills. Many banks encourage employees to take courses at local colleges and universities. In addition, banking associations sponsor a number of programs, sometimes in cooperation with colleges and universities. The American Bankers Association (ABA) offers the most extensive national program for bank officers. Each of its dozen schools located all over the country deals with a different phase of banking. Officers attend annual sessions of one or two weeks and receive degrees after one to three years in areas such as commercial lending, installment credit, and international banking. ABA also sponsors annual seminars and conferences and provides textbooks and other educational materials. Many banks pay all or part of the costs for those who successfully complete courses.

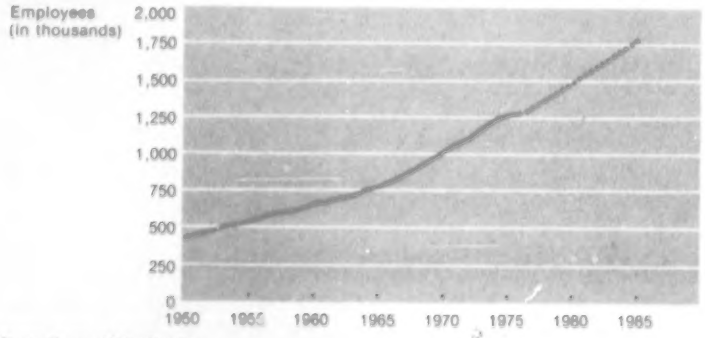
Support personnel can prepare for better jobs through courses offered by the American Institute of Banking (AIB), an arm of the ABA. The Institute, which has over 400 chapters in cities across the country and numerous study groups in small communities, also offers correspondence study and assists local banks in conducting cooperative training programs. The great majority of banks use AIB facilities; many banks use other training sources as well.

Salary practices in banks resemble those in many other industries. Most banks review a new employee's salary twice during the first year. Thereafter, employees generally are considered for a salary increase once a year. In addition to salary, many banks provide compensation as an incentive to outstanding performance, such as selling services or increasing deposits. The employee usually receives this compensation as an immediate or yearend bonus.

Bank employees should enjoy working with numbers and should be able to handle large amounts of money. They should present a good image to customers. Often bank officials are encouraged to participate in community activities.

Employment in the banking industry will continue to grow very rapidly as banks improve and expand services

Wage and salary workers in the banking industry, 1950-76 and projected 1985



Source: Bureau of Labor Statistics

Employment Outlook

Banks should continue to be a major source of job opportunities in office occupations. Banking employment is expected to rise faster than the average for all industries through the mid-1980's. New jobs resulting from employment growth, as well as those that arise as employees retire, die, or stop working for other reasons, are expected to account for tens of thousands of openings each year. Moreover, most entry-level openings should be open to all qualified candidates. While a friend's referral may help the applicant get his or her foot in the door, especially in smaller establishments, most banks

rely upon walk-in applicants as their single largest source of new personnel.

Most openings occur at the clerical level. High turnover among tellers should result in numerous job openings. Particularly strong demand is expected for office machine and computer operators.

Two kinds of opportunities exist for the college graduate: As trainees for officer or managerial positions, and as professional personnel such as accountants, auditors, statisticians, computer programmers, and systems analysts.

A growth in bank facilities and a rise in population, sales, and incomes will result in more financial transactions. Jobs also will be created as banks continue to improve and expand services such as bank charge cards and the handling of accounts for retail stores. As banks strive to bring these and other services closer to suburban areas, branch banks will grow in number and provide additional employment opportunities.

The continued conversion to electronic data processing may lessen demand for some bank workers, despite the expected increase in bank services. The effect of this development will vary by occupation, as indicated in the statements on specific banking occupations elsewhere in the *Handbook*.

Bank employees are less likely to be laid off during periods of low business activity than workers in many other fields. Even when a bank is sold or merged, workers seldom lose their jobs. Bank officials usually reduce employment, when necessary, by not replacing employees who leave their jobs.

Earnings and Working Conditions

In addition to salaries, bank workers generally receive liberal fringe benefits. For example, most banks have some type of profit-sharing or bonus plan. Group plans that provide life insurance, hospitalization, surgical benefits, and retirement income are common. Sometimes free checking accounts or safe-deposit boxes also are provided. These fringe benefits, along with job stability, may compensate for the fact that banking salaries tend to be lower than those paid for comparable positions in other industries.

The workweek in banks is generally 40 hours or less; in a few localities, a workweek of 35 hours is common. Tellers and some other employees may work at least one evening a week when banks remain open for business. Certain check processors and operators of computing equipment may work on evening shifts.

Sources of Additional Information

General information about banking occupations, training opportunities, and the banking industry itself is available from:

American Bankers Association, Bank Personnel Division, 1120 Connecticut Ave. NW., Washington, D.C. 20036.

National Association of Bank Women, Inc., National Office, 111 E. Wacker Dr., Chicago, Ill. 60601.

National Bankers Association, 4310 Georgia Ave. NW., Washington, D.C. 20011.

For information about career opportunities as a bank examiner, contact:

Federal Deposit Insurance Corporation, Director of Personnel, 550 17th St. NW., Washington, D.C. 20429.

Information on careers with the Federal Reserve System is available from:

Board of Governors, The Federal Reserve System, Personnel Department, Washington, D.C. 20551 or from the personnel department of the Federal Reserve bank serving each geographic area.

State bankers' associations can furnish specific information about job opportunities. Writing directly to a particular bank to inquire about job openings also can produce favorable results. For the names and addresses of banks in a specific location as well as the names of their principal officers, consult one of the following directories, which are published twice each year:

The American Bank Directory, (Norcross, McFadden Business Publications).

Bankers Directory—The Banker's Blue Book, (Chicago, Rand McNally International).

Polk's World Bank Directory, (Nashville, R.L. Polk & Co.).

OCCUPATIONS IN THE INSURANCE INDUSTRY

The insurance industry offers many employment opportunities both for recent high school and college graduates and for experienced workers.

The 1,800 life and 2,800 property-liability (also called casualty) insurance companies do business in home and regional offices and also in thousands of sales offices throughout the country.

Nature of the Business

There are three major types of insurance: life, property-liability, and health. Some companies specialize in only one type; a growing number of large insurers now offer several lines of insurance. For example, several life insurance carriers can now offer their policyholders protection for their homes and cars; at the same time, major property-liability companies sell life insurance policies. Many insurance companies also offer mutual fund shares and variable annuities as additional investment choices for their customers.

Life insurance companies sell policies that provide benefits to survivors upon the death of the insured. Some life insurance policies also provide policyholders with a steady income when they reach retirement age or if they become disabled; policies may be designed to help provide funds to educate children when they reach college age, or give extra financial protection while the children are young. Life insurance policies also may be used to protect business interests and to guarantee employee benefits. Property-liability insurance provides policyholders with protection against loss or damage to their property, and protects them from financial responsibility for injuries to others or damage to other people's property. It covers hazards such as fire, theft, and windstorm, as well as workers' compensation and other claims. Most life and property liability companies sell accident and health insurance, which helps policyholders pay medical expenses, and may furnish other benefits for an injury or illness.

An increasing number of insurance policies cover groups ranging from a few individuals to many thousands. These policies usually are issued to employers for the benefit of their employees. Most common are group life and health plans, although the number of group automobile and homeowner policies is growing rapidly. In 1976, group life insurance protected about 75 million persons; the number of policies was about 60 percent higher than the number 10 years earlier.

Insurance Workers

About 1.6 million people worked in the insurance business in 1976. The majority were in clerical and sales jobs. (See accompanying chart.)

Nearly half of all insurance workers have clerical jobs; only the banking industry has a larger proportion of employees doing clerical work. In insurance, clerical workers keep records of premium payments, services, and benefits paid to policyholders. Most are secretaries, stenographers, typists, statistical clerks, office machine operators, or general office clerks. They do work similar to that of their counterparts in other businesses.

Other clerical workers have positions of greater responsibility that require extensive knowledge of some phase of insurance. They include *claim adjusters* (D.O.T. 241.168) and *claim examiners* (D.O.T. 249.268) who decide whether claims are covered by the policy, see that payment is made, and, when necessary, investigate the circumstances surrounding the claim. (See the statement on Claim Representatives elsewhere in the *Handbook*.)

Nearly one-third of all insurance employees are sales workers—chiefly agents and brokers who sell policies to individuals and business firms. *Agents and brokers* (D.O.T. 250.258) usually find their own customers or "prospects," and see that each policy they sell meets the individual needs

Nearly half of all insurance workers have clerical jobs.

of the policyholder. (See the statement on insurance agents and brokers elsewhere in the *Handbook*.)

About one out of eight insurance workers has a managerial job. Managers of local sales offices often spend part of their time selling. Others, who work in home offices, are in charge of departments such as actuarial calculations, policy issuance, accounting, and investments.

Professionals, employed mainly at home offices, represent about 1 out of 15 insurance workers. These specialists, who work closely with insurance company managers, study insurance risks and coverage problems, analyze investment possibilities, prepare financial reports, and do other professional work. Among them is the *actuary* (D.O.T. 020.188) whose job is unique to the insurance field. Actuaries make studies of the probability of an insured loss and determine premium rates. (See the statement on actuaries elsewhere in the *Handbook*.) Another specialist is the *underwriter* (D.O.T. 169.188), who evaluates insurance applications to determine the risk involved in issuing a policy. Underwriters decide whether to accept or reject the application; they also determine which premium rate should apply for each policy issued. (See the statement on underwriters elsewhere in the *Handbook*.)

Other professional employees do essentially the same work in insurance companies as in other businesses. Accountants, for example, analyze insurance company records and financial problems relating to premiums, investments, payments to policyholders, and other aspects of the business. Safety engineers, fire protection engineers, and industrial hygienists in casualty companies consult with industrial and commercial policyholders on matters concerning the health and safety of their employees. (See the statement on occupational safety and health workers elsewhere in the *Handbook*.) Lawyers interpret the regulations that apply to insurance company operations and handle the settlement of some insurance claims. Investment analysts evaluate real estate mortgages and new issues of bonds and other securities, analyze investments held by their companies, and recommend when to hold, buy, or sell. As more computers are installed to process insurance records, an increasing number of programmers, systems analysts, and other data processing specialists are being employed. Most companies also employ public relations, sales promotion, and advertising specialists.

As more computers are installed to process insurance records, an increasing number of data processing specialists are being employed.

Insurance companies require the same kinds of custodial and maintenance work as other large organizations. About 1 out of 45 workers in the insurance business performs these duties.

Places of Employment

Insurance company home and regional offices generally are located near large urban centers. Nearly one-half of all persons employed in these large offices work in seven States: New York, California, Illinois, Texas, Pennsylvania, Ohio, and Massachusetts. Insurance workers who deal directly with the public—sales personnel and claim adjusters—are located throughout the country. Almost all insurance agents and brokers work out of local company offices or independent agencies. Many claim adjusters work in independent firms located in small cities and towns throughout the country. Company operated drive-in claim centers are located in many medium-sized towns.

About half of all insurance employees work in life companies and agencies. Included in this group are some very large companies with thousands of employees; nearly one-third of life company workers are employed in firms of more than 1,000 people. Property-liability companies, although more numerous than life insurance companies, generally have fewer workers; fewer than one in five of those employed in casualty companies work in establishments of 1,000 or more. Most local agencies and sales offices are relatively small, regardless of the types of insurance handled. About 60 percent of these offices employed fewer than 20 persons.

Training, Other Qualifications, and Advancement

Insurance offers job opportunities for people with different educational backgrounds and talents. Some positions require specific college training; others can be filled by workers with limited academic training and few skills.

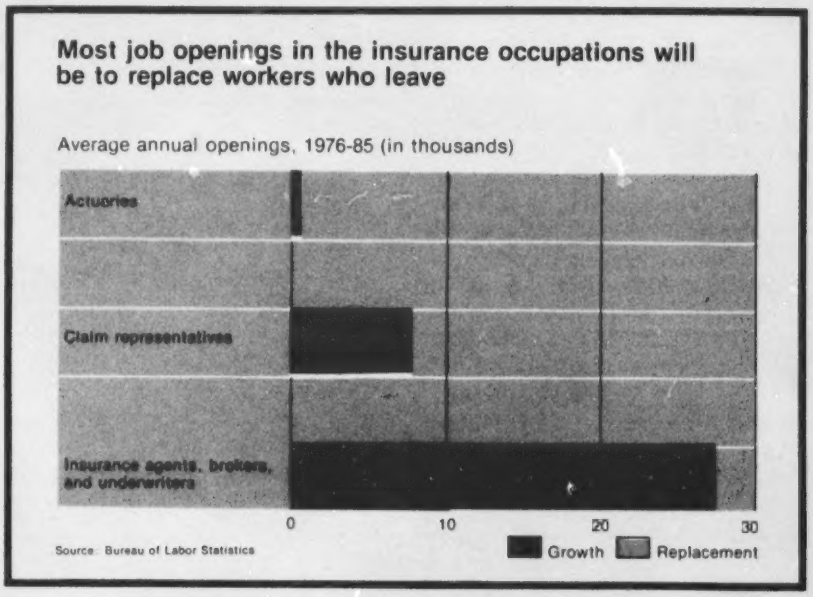
Graduation from high school or business school is enough training for most beginning clerical jobs. Courses in typing and business math are assets; the ability to operate office machines also is helpful. These and other special skills help beginners advance to more responsible jobs.

Jobs in engineering, accounting, and other professional fields generally require the same kinds of college training here as in other businesses. College-trained people also are preferred for managerial positions, many of which are filled by promotion from within.

In all work requiring contact with the public, employees should have a pleasant disposition and an outgoing personality. Those in frequent contact with policyholders should be able to inspire confidence in their ability to protect the customer's interests. Because insurance companies often encourage their managers and administrative employees to participate in community organizations, they should be people who enjoy

working with others in a social situation.

Insurance workers have ample opportunity to continue their education. The Insurance Institute of America, for example, has home study courses for claim adjusters, claim examiners, underwriters, and sales workers. The American College of Life Underwriters, the National Association of Life Underwriters, and the Life Underwriter Training Council offer courses that stress the services agents provide to policyholders. Other courses, especially designed to help clerical employees better understand life insurance, relate to the organization and operation of both home and field offices. These are given by the Life Office Management Association, which also provides programs for the development of supervisors and managers.



Employment Outlook

Employment of insurance workers is expected to increase about as fast as the average for all occupations through the mid-1980's as the insurance industry continues to expand. In addition to new jobs that will become available, thousands of openings will occur as employees die, retire, or leave their jobs to seek other work.

The expected increase in employment will result mainly from a growing volume of insurance business. As a larger proportion of the population enters the age group normally associated with family formation, higher incomes, and greater consumer spending, insurance sales should expand. Sales of life insurance will rise as the growing number of young adults attempt to provide a secure future for their families. Property-liability insurance sales should expand as they buy homes, cars, and other items that require insurance protection. More business insurance will be needed as new plants are built, new equipment is installed, and more goods are shipped throughout the country and the world. Additional sales will be generated by a rising demand for relatively new services such as dental, prepaid legal, and kidnap insurance. Furthermore, the growing concern over the health and safety of industrial workers and consumers will spur demand for men and women to work in the areas of occupational safety and health, product liability, and workers' compensation.

Growth of insurance employment, however, is not expected to keep pace with the expanding volume of business for several reasons. Sales workers are expected to become more productive as more insurance is sold through group contracts and multiple-line policies (those that cover many different risks formerly covered in separate policies). Although the total number of clerical jobs probably will continue to rise, the increasing use of computers to do routine jobs will lessen the demand for many low-skilled clerical workers. In addition, State "no-fault" insurance plans should reduce the number and complexity of automobile claims to be adjusted, thus lessening the demand for automobile claim adjusters.

The insurance industry has always been a stable employer and most insurance workers have better prospects of regular employment than workers in many other industries. Business people usually regard property-liability insurance as a necessity, both during economic recession and in boom periods. Individuals who buy insurance try to provide as much basic financial protection as possible, even when their incomes decline.

Earnings and Working Conditions

Earnings of nonsupervisory office workers in insurance companies averaged $170 a week in 1976, slightly below the average for all industries. There were significant differences in earnings depending upon the type of insurance company. For example, workers in companies specializing in accident and health insurance averaged $164 a week, while employees in life companies earned $167 and workers in casualty companies were paid average weekly salaries of $174. Salary levels in different parts of the country also vary; earnings are generally lowest in southern cities and highest in northeastern and western metropolitan areas. Within a geographic region, salaries usually are higher in the larger companies.

A 1976 survey of life insurance companies revealed a wide range of clerical salaries. File clerks earned about $117 a week and typists received about $124. Executive secretaries averaged about $234 and experienced computer operators were paid average weekly salaries of $220.

Starting salaries for professional workers are generally comparable to

those for similar positions in other businesses. According to information available from private surveys of life and property-liability insurance companies, 1976 college graduates started at salaries ranging from $8,500 to $12,000 a year. Specialists with graduate degrees or several years' experience may receive considerably higher starting salaries. Unlike salaried professional workers, agents and brokers earn commissions on the policies they sell. (See the statement on insurance agents and brokers elsewhere in the *Handbook*.) Annual salaries for supervisors in life and property-liability companies ranged from $17,000 to $25,000. Those in executive positions earned between $35,000 and $50,000 a year in 1976, depending upon their area of specialization and level of responsibility.

Except for agents and brokers who sometimes must extend their working hours to meet with prospective clients, insurance company employees worked an average of 37 hours a week in 1976. The number of paid holidays is somewhat greater than in many other industries. Two-week paid vacations generally are granted employees after 1 year of service; in most companies, paid vacations are extended to 3 weeks after 5 years and, in some, to 4 weeks after 10 years. Practically all insurance company workers share in group life and health plans, as well as in retirement pensions.

Sources of Additional Information

General information on employment opportunities in the insurance business may be obtained from the personnel departments of major insurance companies or from insurance agencies in local communities.

Other information on careers in the insurance field is available from:

American Council of Life Insurance, 1850 K St. NW., Washington, D.C. 20006.

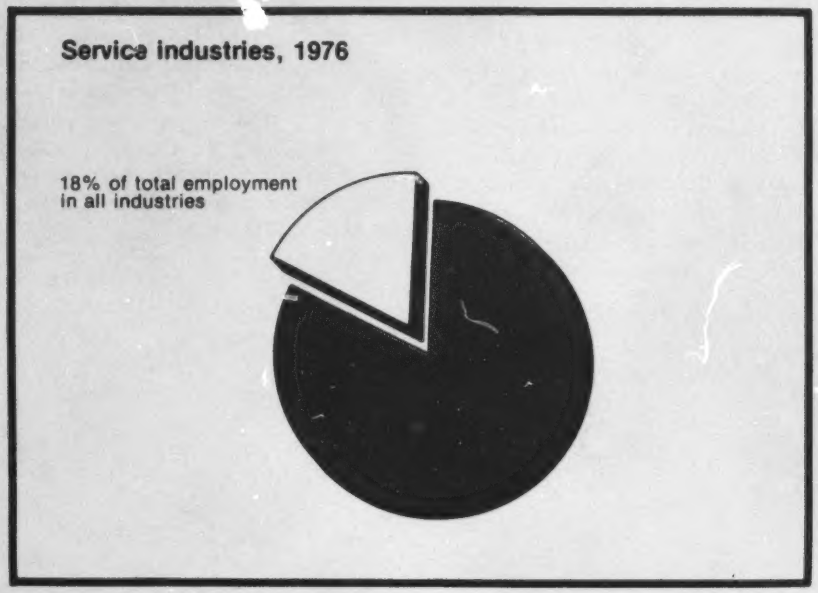
Insurance Information Institute, 110 William St., New York, N.Y. 10038.

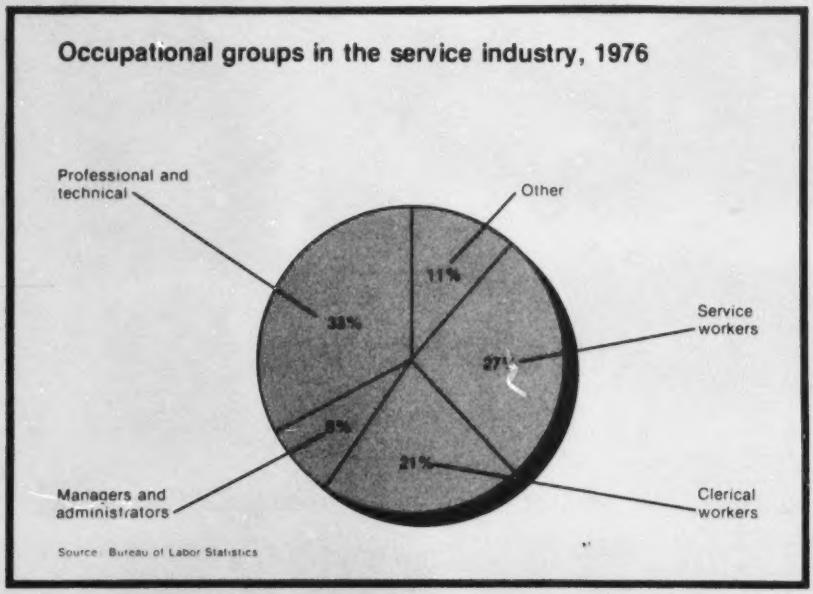
American Mutual Insurance Alliance, 20 N. Wacker Dr., Chicago, Ill. 60606.

National Association of Independent Insurers, Public Relations Department, 2600 River Rd., Des Plaines, Ill., 60018.

SERVICE AND MISCELLANEOUS INDUSTRIES

An increasing share of our national wealth is being devoted to services as a result of greater emphasis on amenities such as health care, education, and recreation. In many ways, this trend reflects the country's goals of a better and fuller life for all its citizens.





In today's job market, the service industries are a major source of employment, for new workers as well as experienced ones. They offer job opportunites to people at all levels of skill, training, and education.

In 1976, nearly 30 million people worked in service industries. Nearly one-half were wage and salary workers in private firms, including over 1 million private household workers; over 13.1 million more were government employees (mainly in education, health, and public administration); and about 2.3 million were self-employed.

Educational services, including elementary and secondary schools and institutions of higher education, make up the largest sector of the service industry, and account for about one-fourth of its work force. Medical services, including hospitals, offices of physicians, and other establishments that provide health services, constitute the next largest sector, and account for about one-fifth of the workers. The Postal Service and Federal, State, and local public administration account for about one-sixth of service workers. Other service industries employing many workers are hotels, laundries, beauty and barber shops, private households, business and repair services, welfare and religious organizations, and entertainment.

As shown in the accompanying tabulation, white-collar workers (professional, managerial, clerical, and sales workers) account for over three-fifths of the service industry's employment. The industry employs the highest proportion of professional, technical, and kindred workers of any major industry; these workers account for about one-third of the industry's employment. By far the largest concentration of professional personnel is represented by teachers in educational services. Other major

employers of professional workers are medical and health services—where doctors, dentists, and nurses constitute a large share of the work force. The government employs many professionals in administrative jobs. Many professionals are self-employed. Clerical workers account for about 1 out of 5 service industry employees. Most are stenographers, typists, secretaries, and office machine operators. Managers, officials, and proprietors, including health services administrators, make up less than one-tenth of the industry's employment.

Service workers represent over one-fourth of the industry's employment. Some large service occupations are private household worker, practical nurse, hospital attendant, janitor, waiter and waitress, cook, and protective service worker.

Blue-collar workers, mainly skilled craft workers and semiskilled operatives, constitute only one-tenth of the industry's employment. Many of the craft workers are mechanics in automobile and other repair service industries, or maintenance workers in hotels, schools, and other establishments. Operatives work mainly in laundries, auto repair shops, and other types of repair businesses. Most of the relatively few laborers in this industry work in auto repair shops, on golf courses, and in bowling alleys.

Employment in the service industry is expected to increase faster than the average for all industries through the mid-1980's. The growth in the demand for services is expected to stem from population growth, expanding business activity, and rising personal incomes. Among the fastest growing segments of the industry will be hospitals, medical services, and computer software firms.

The importance of personal contact in many service activities tends to limit the effect of technological innovations on employment requirements. Although computers may slow the employment growth in some areas—for example, in bookkeeping— technological change is not expected to significantly limit the total demand for workers in the service industry.

The statements that follow discuss job opportunities in the hotel and laundry and drycleaning industries. More detailed information about services related to occupations that cut across many industries appears elsewhere in the *Handbook*.

HOTEL OCCUPATIONS

Hotels, motels, and resorts provide lodgings to suit the needs of every traveler. Some motels offer inexpensive basic services for those who simply want a comfortable place to sleep. Other motels and most hotels cater to persons who desire more luxurious surroundings and offer fine restaurants, personal service, and many recreational facilities that may include swimming pools, golf courses, tennis courts, horseback riding, game rooms, and health spas. About 890,000 people worked in this industry in 1976.

This statement gives an overview of jobs in hotels, motels, and resorts. Separate *Handbook* statements describe the work of hotel housekeepers, managers, front office clerks, and bellhops.

The Hotel Business

Hotels range in size from those with only a few rooms and employees to huge establishments with more than 1,000 rooms and hundreds of workers. Many of the motels built in recent years are fairly large and employ many workers, but the economy motels and most older motels have relatively small staffs. In fact, some motels are run entirely by owners and their families.

Nearly all hotels and many motels offer a variety of conveniences for their guests, including restaurants, banquet rooms, meeting rooms, swimming pools, and gift shops. Motels usually have simple coffee shops, while hotels often have several restaurants and may offer live entertainment at night. Hotels and motels in resort areas often have a wide variety of recreational facilities including golf coures, tennis courts, and swimming pools. Large hotels also may have newsstands, barber and beauty shops, laundry and valet services, and theater and airline ticket counters.

Some hotel occupations require little or no specialized training.

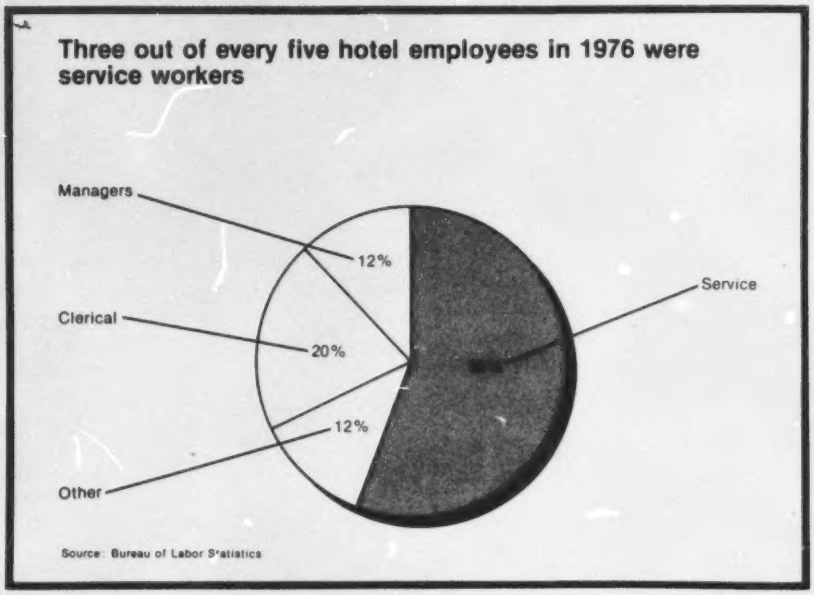
Hotel Workers

As hotel operations become more complex, the emphasis on training is increasing. Demand for persons with special skills and training at colleges, junior colleges, technical institutes, vocational schools, and high schools is increasing. Also, many employees, particularly managers, undergo comprehensive on-the-job training programs.

To provide the many services they offer, hotels and motels employ workers in a wide variety of occupations. These usually are classified as professional, middle management, and service and craft occupations. Professional positions such as general manager, food and beverage manager, personnel director, and administrative chef generally require considerable formal training and job experience. Middle management occupations such as auditor, purchasing agent, executive housekeeper, and chef generally require formal training and extensive on-the-job training. Jobs such as bellhop, cleaner, bartender, and waitress generally require less training.

Housekeeping is a very important part of the business and more than a fourth of all workers are concerned with keeping hotels and motels clean and attractive. The housekeeping staff make beds, provide guests with fresh linens and towels, vacuum rooms and halls, and move furniture. Linen room attendants and laundry room workers mark and inspect towels, sheets, and blankets and operate the washing and pressing machines in the hotel laundry. Large hotels and motels usually employ executive housekeepers to supervise these workers and purchase housekeeping supplies. Some hotels also employ managers to supervise laundry operations.

Food service personnel comprise



the next largest group of hotel workers. These workers include cooks and chefs, waiters and waitresses, meatcutters, dining room attendants and dishwashers, food counter workers, and bartenders who work in the coffee shops and restaurants found in most motels and hotels. Detailed descriptions of their duties are found elsewhere in the *Handbook*.

Hotel managers and assistants are responsible for the profitable operation of their establishments. They determine room rates, oversee restaurant operations, and supervise the staff. In smaller hotels and motels a general manager performs all these tasks, but in large hotels a general manager usually has several assistants, each one responsible for a separate department, such as food service, sales, or personnel.

Nearly all hotels and motels employ clerical workers to take room reservations, bill guests, and furnish information. Most of these workers are front office clerks who greet guests, assign rooms, handle mail, and collect payments. The remainder are cashiers, bookkeepers, telephone operators, secretaries and other clerical workers, whose jobs in hotels are much like clerical jobs elsewhere.

Hotel reservation personnel coordinate reservations for all hotels and motels in the company's system.

Most hotels and some motels employ a uniformed staff to perform services for guests. This staff includes bellhops, who carry baggage and escort guests to their rooms; doorkeepers, who help guests out of their cars or taxis and carry baggage into the hotel lobby; and elevator operators.

In addition, hotels employ many other workers who are also found in other industries. Among these are accountants, personnel workers, entertainers, and recreation workers. Maintenance workers, such as carpenters, electricians, stationary engineers, plumbers, and painters, also work for hotels. Still others include detectives, barbers, cosmetologists, valets, gardeners, and parking attendants. Most of these occupations are discussed elsewhere in the *Handbook*.

Employment Outlook

Employment in this industry is expected to expand more slowly than the average for all industries through the mid-1980's. Although new hotels and motels are expected to be built to take advantage of in-town, interstate highway, or resort locations, desirable sites are becoming scarce and very expensive. As a result, many owners are expected to rehabilitate and modernize existing hotel properties rather than construct new properties. In addition to openings resulting from growth, thousands of workers will be needed each year to replace those who retire, die, or leave the industry.

Most of the anticipated employment growth will stem from the need to staff new hotels and motels. Although employment is expected to increase in both luxury and economy motels as Federal expenditures for highways and other transportation systems stimulate travel,both business and pleasure travel are sensitive to economic and business conditions. More hotels are adding facilities and services for recreation in an effort to attract greater numbers of travelers, particularly from nearby areas. Older hotels unable to modernize are likely

to experience low occupancy rates that may force them to reduce costs by eliminating some services and workers. Meanwhile, thousands of temporary jobs will continue to be available each year in resort hotels and motels that are open only part of the year.

Most of the job openings in hotels and motels will be for workers who need limited training, such as cleaners, porters, and some dining room employees. Large numbers of jobs will be available for front office staff, but opportunities may be limited by the increasing use of computer reservation systems in hotel and motel chains.

Opportunities may be particularly favorable for persons with training or experience as cooks and chefs or as food managers.

Earnings and Working Conditions

Earnings of hotel workers depend on the location, size, and type of the hotel in which they work. Large luxury hotels and those located in metropolitan and resort areas generally pay their employees more than less expensive hotels and those located in less populated areas. Workers in some occupations receive tips in addition to wages that add substantially to their income. Nonsupervisory workers in the hotel industry averaged $3.03 an hour in 1976, excluding tips—compared to $4.87 an hour for all nonsupervisory workers in private industry, except farming. About three-fourths of all hotel workers are covered by Federal and State minimum wage laws; in 1976, workers covered by these laws earned at least $2.20 an hour.

Salaries of hotel managers and assistants are particularly dependent upon the size and sales volume of the hotel, and vary greatly because of differences in duties and responsibilities. Hotel manager trainees who are graduates of specialized college programs generally start at around $10,000 a year and usually are given periodic increases for the first year or two. Experienced managers may earn several times as much as beginners. For example, salaries of hotel general managers ranged from about $16,000 to $50,000 a year in late 1975, according to a survey conducted by the American Hotel and Motel Association. Hotel food and beverage managers earned from about $12,000 to $30,000 and executive housekeepers from about $7,000 to over $20,000. Managers may earn bonuses ranging from 10 to 20 percent of basic salary in some hotels. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

The American Hotel and Motel Association also publishes wage data taken from union contracts of hotels and motels in major U.S. cities. Hourly rates during 1976 varied widely from city to city. Bellhops earned from $1.34 to $2.52 per hour, cleaners from $2.17 to $4.22, laundry workers from $2.25 to $4.52, bartenders from $2.48 to $5.85, waiters and waitressess from $1.38 to $3.05, elevator operators from $2.19 to $4.65, telephone operators from $2.40 to $4.64, and maintenance workers from $2.36 to $5.30. Tips, which represent a significant source of income for many employees, are not included in these data.

Since hotels are open continuously, employees must work on shifts. Fewer employees work at night than during the day; those who work on night shifts often receive additional compensation. Managers and housekeepers who live in the hotel usually have regular work schedules, but may be called for work at any time.

Food service personnel may receive extra pay for banquets and other special occasions and commonly receive meals. In some hotels, cleaners, elevator operators, room clerks, and others also receive meals. Most employees receive 5 to 10 paid holidays a year, paid vacations, sick leave, life insuance, medical benefits, and pension plans. Some hotels offer bonuses, profit sharing plans, educational assistance, and other benefits to their employees.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Some hotel workers, including bellhops, porters, cleaners, cooks, housekeepers, waiters and waitresses, maintenance engineers, elevator operators, guards, door attendants, gardeners, laundry workers, and others are members of the Service Employees' International Union.

Sources of Additional Information

Information on careers and scholarships in the lodging industry may be obtained from:

The Educational Institute of the American Hotel and Motel Association, 1407 S. Harrison Rd., East Lansing, Mich. 48823.

For a directory of colleges and other schools offering programs and courses in hospitality education, write to:

Council on Hotel, Restaurant, and Institutional Education, 11 Koger Executive Center, Suite 219, Norfolk, Va. 23502.

Information on careers in housekeeping and a list of schools offering programs in institutional housekeeping management is available from:

National Executive Housekeepers Association, Inc., Business and Professional Building, 414 Second Ave., Gallipolis, Ohio 45631.

OCCUPATIONS IN LAUNDRY AND DRYCLEANING PLANTS

In 1976, approximately 418,000 persons were employed by establishments that launder and dryclean garments, household furnishings, and institutional linens and uniforms. These workers were employed throughout the country, but were concentrated in metropolitan areas.

Drycleaning firms and laundries accounted for about three-fourths of the industry's workers. Most of the remainder worked for firms that specialized in renting and cleaning uniforms, towels, diapers, and other linens. A small proportion were employed in valet shops.

More than half of the industry's employment is found in firms that have 20 employees or more. Most firms, however, are owner-operated and have fewer than 10 employees. In 1976, about one-seventh of the industry's workers were self-employed.

Nature of the Work

One way to describe the work done in this industry is to follow an imaginary bundle of clothes from the time it leaves the customer until it is cleaned and returned. (See accompanying chart.) The bundle consists of some men's shirts, a business suit, and bed linens. A *route driver* (D.O.T. 292.358) picks up the bundle and, after leaving a receipt, takes the bundle to the plant.

The owner of the bundle may instead leave it at the plant or drive-up store. In this case, a *counter clerk* (D.O.T. 369.887) makes out a receipt. Either the route driver or the counter clerk sorts the items in the bundle into laundry and drycleaning.

The bundle is turned over to a *marker* (D.O.T. 369.887), who puts an identifying symbol on each item so it may be matched with the customer's receipt at some later time. The marker then sends the shirts and sheets to the washroom and the suit to the drycleaning room.

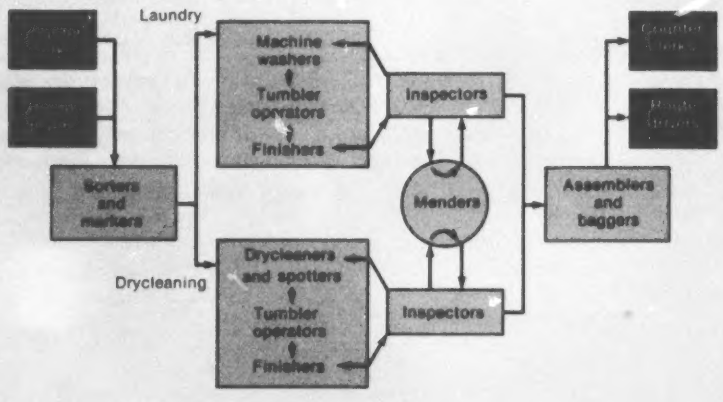
A *machine washer* (D.O.T. 361.885) puts several hundred pounds of sheets into a huge washing machine. Shirts are loaded into another washer. These machines are controlled automatically, but the machine washer must understand how to operate the controls—water temperature, suds level, time cycles, and the amount of agitation for different fabrics. When the washing cycle is completed, the laundry is transferred to an extractor that removes about half of the water. This stage is similar to the "spin" cycle on a home washer. Conveyors move the laundry to conditioners, dryers, or tumblers where dry, heated air removes some of the remaining moisture.

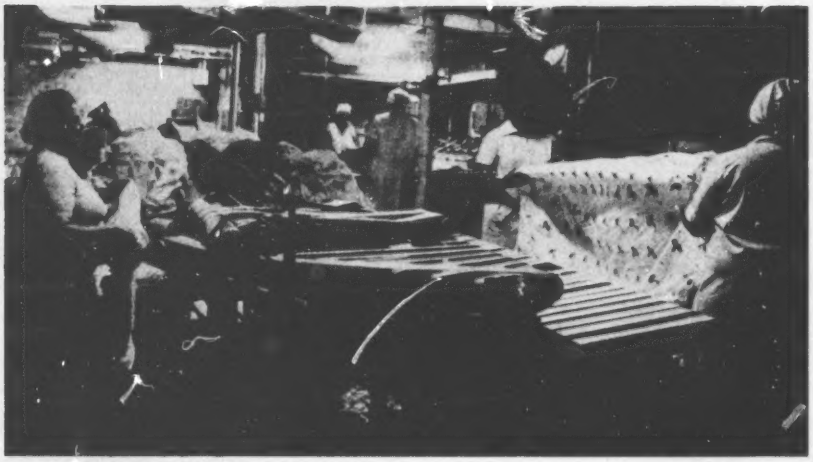
Sheets go from the drying area to *flatwork finishers* (D.O.T. 363.886), who shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines for ironing and partial folding. When the sheets come out of the machine, other finishers complete the folding and stacking.

Shirts go directly from the extractor to *shirt finishers* (D.O.T. 363.782), who usually work in teams of two or three. One finisher puts the sleeves of the shirt on a "sleever," which has two armlike forms. A second finisher then puts the shirt on a "triple-head" press that irons the front and back simultaneously. In some plants, the first finisher either folds the shirt or places it on a hanger, whichever the customer has indicated. A third finisher may do the folding. In some laundries, one shirt finisher performs all these operations.

The jobs of the *drycleaner* (D.O.T. 362.782) and *machine washer* (D.O.T. 361.885) are similar, but the cleaning solution for drycleaning is a chemical solvent instead of water, and drycleaning machines generally are smaller than the laundry washers. The drycleaner sorts clothes according to color, fiber content, and fabric construction and selects the proper time cycle for each load. The drycleaner may apply special prespotting solutions to spots and stains before placing the garments in the

How work flows through a laundry and drycleaning plant





Flatwork finishers shake out folds and creases, spread the sheets on moving belts, and feed them into large flatwork ironing machines.

drycleaning machine. After cleaning, a special machine removes the solvent and then the clothes are dried in a tumbler or hot-air cabinet. The *spotter* (D.O.T. 362.381) will use chemical reagents and steam to remove stubborn stains. In some plants, the same person does drycleaning and spotting.

If the clothes are made of a material that sheds wrinkles readily, the finisher places them on hangers and puts them in a steam tunnel or steam cabinet. The steam will remove the wrinkles and help the garment regain its shape.

Some clothes, such as men's suits, are made out of fabrics that require more attention; they are finished differently. A *men's suit finisher* (D.O.T. 363.782) puts the pants on special "topper" and "legger" presses. The jacket is placed on a body form that may have a second part that comes down to press and shape the shoulders and collar of the jacket while the steam is forced from the inside. Final finishing touches are done on a steam-heated pressing head and "buck," a flat surface covered in fabric.

An *inspector* (D.O.T. 369.687) checks finished items to see that the quality standards of the plant have been maintained. Any item in need of recleaning or refinishing may be returned to the appropriate department; occasionally, the inspector works on them instead. Repair work may be forwarded to a *mender* (D.O.T. 782.884), who sews on buttons, mends tears, and resews seams. Finally, *assemblers* (D.O.T. 369.687) collect the linens and shirts by matching the sales invoice with the identification marks. Assemblers or *baggers* (D.O.T. 920.887) may remove tags before putting the items in bags or boxes for storage until called for by the customer or delivered by the route driver.

In addition to workers who are unique to laundry and drycleaning plants, many other workers are found in this industry. The manager or proprietor sees that the plant operates efficiently. Office workers keep records, handle correspondence, and prepare bills. Sales personnel search for new customers. Mechanics keep equipment and machinery operating properly. Some service workers clean, guard, and otherwise maintain the plant; others plan and serve food to plantworkers. Laborers lift and carry heavy loads to machines. (Many of these occupations are discussed elsewhere in the *Handbook*.)

Some clothes are made of fabrics that require special attention.

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Training, Other Qualifications, and Advancement

Many workers in this industry get their first jobs without previous training. Persons who have little formal education can get production line jobs in drycleaning plants. Basic laundry and drycleaning skills may be learned on the job in a short time. Some jobs, such as folding towels and feeding pillowcases and sheets into a flatwork ironer, may require 1 or 2 days to learn. Some finishing jobs—pants presser, or shirt finisher, for example—may require less than a week's training. Other jobs, such as counter clerk, marker, inspector, and assembler, may require several weeks to learn. Several months or more are needed to train a drycleaner or women's apparel finisher. It may take 6 to 12 months to become a spotter because of the variety of fibers and fabrics, spots and stains, and chemicals used in treating the stains.

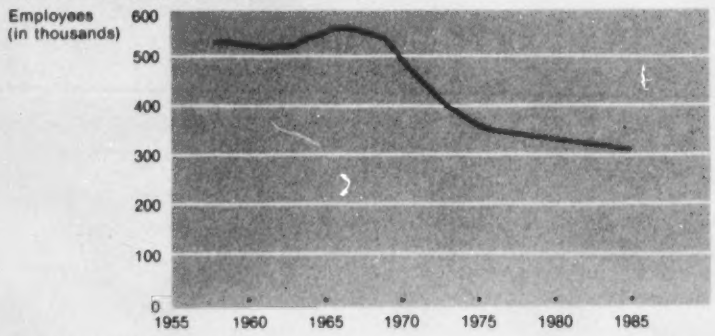
Some preemployment training in finishing, drycleaning, and spotting skills is available in vocational high schools and trade schools. Home study courses in all operations of the industry are available from the International Fabricare Institute.

Employers look for dependable workers who have physical stamina, manual dexterity, and keen eyesight. Workers must be able to adjust to the repetitive nature of many laundry and drycleaning jobs.

Advancement for most workers in this industry is limited. Many remain permanently in the same job. Nevertheless, employers occasionally send promising employees to technical or managerial training programs given by the International Fabricare Institute at its facility in Joliet, Ill. Some men's suit finishers become skilled

Laborsaving machinery and improved methods enable laundries and drycleaning plants to do more work with fewer employees

Wage and salary workers in laundries and drycleaning plants, 1958-76 and projected 1985



Source: Bureau of Labor Statistics

enough to do women's apparel finishing. Markers and assemblers interested in finishing work usually are given an opportunity to move up to this job. Finishers also may become inspectors. Supervisors and managers frequently are chosen from experienced employees already in the industry. Some drycleaners and spotters establish their own drycleaning plants.

Employment Outlook

Employment in this industry is expected to decline through the mid-1980's. Laborsaving machinery and more efficient methods of cleaning and finishing laundry will enable the industry to do more work with fewer employees. Nevertheless, thousands of workers will be hired to replace those who retire, die, or transfer to other fields.

Although the industry's total employment is expected to decline, employment trends will differ among occupations. Employment of spotters is expected to decline because new fibers and finishes make fabrics less stainable. The number of finishers should decrease as machinery does more of the finishing work. On the other hand, more people will be needed in some maintenance occupations to repair the increasing amount of machinery and equipment used by laundry and drycleaning firms. More counter clerks will be required due to growth in the number of retail outlets operated by these firms.

Earnings and Working Conditions

Wage levels in the laundry and drycleaning industry are not high. In 1976, the hourly average wage for nonsupervisory workers in this industry was $3.26 compared to $4.36 for all nonsupervisory workers in all service industries and $4.87 for all such workers in private industry, except farming. Earnings are higher for workers in the more highly skilled occupations, such as drycleaner, spotter, and machine washer.

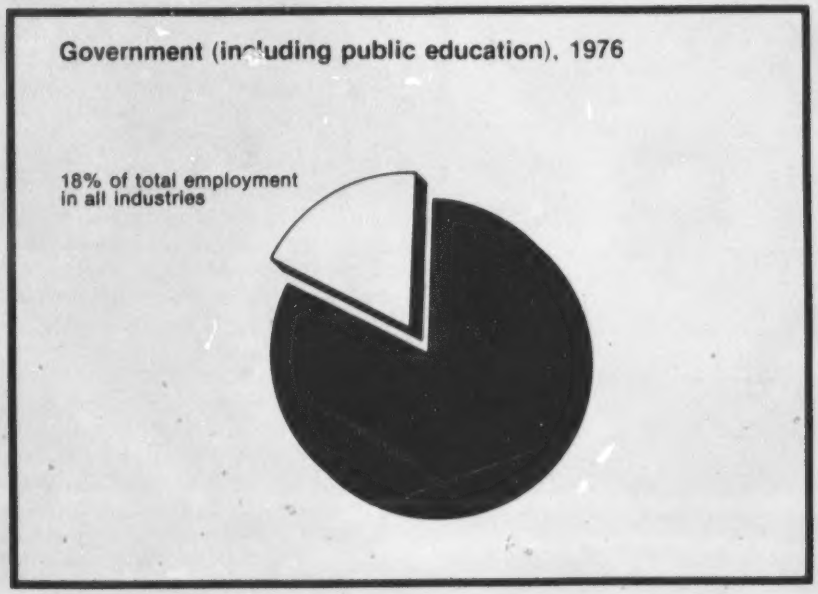
Modern laundry and drycleaning plants are clean and well-lighted. Because of the heat, hot air, and steam of the cleaning processes, the plant may be hot during the summer months. Many new, small drycleaning plants, however, are air-conditioned in the office and customer areas and well-ventilated in the machinery areas. In addition, new machinery operates with a minimum of noise. Work in laundries and drycleaning plants is less hazardous than in most manufacturing plants.

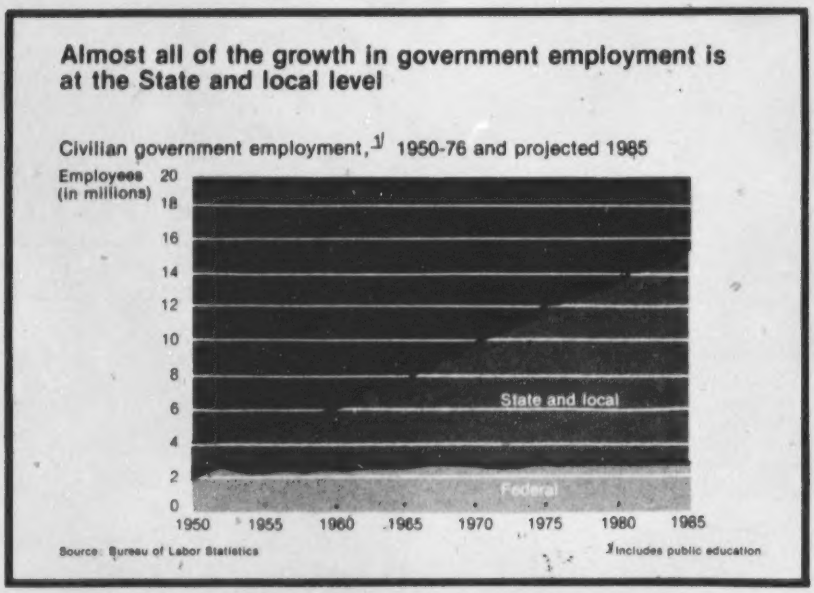
Sources of Additional Information

The local office of the State employment service may have additional information on training and employment opportunities in this field.

GOVERNMENT

Government service, one of the Nation's largest fields of employment, provided jobs for about 15 million civilian workers in 1976—about 1 out of 6 employed persons in the United States. State or local governments (county, city, township, school district, or other special division) employed 4 out of 5 government workers; the remainder worked for the Federal Government.





Government employees represent a significant portion of each State's work force. They work in large cities, small towns, and even in remote and isolated places such as lighthouses and forest ranger stations. A small number of Federal employees work overseas.

Continuing the trend begun in the late 1940's, employment in State and local government is expected to grow faster than the average for all industries through the mid-1980's. Federal employment, on the other hand, is expected to grow much more slowly than the average for all industries. Many job opportunities also will arise at all levels of government as workers retire, die, or leave government service.

Government Activities and Occupations

Two-fifths of all government workers in 1975, or 6.3 million, provided educational services, mostly at the State and local levels in elementary and secondary schools. Besides teachers, others who worked in educational services included administrative and clerical workers, maintenance workers, librarians, dietitians, nurses, and counselors.

More than 1 million civilian employees in 1975 worked for Federal agencies that are concerned with national defense and international relations. Principal occupations that deal with these functions included administrative and clerical workers, health workers, teachers, engineers, scientists, technicians, and craft and other manual workers. People in these jobs work in offices, research laboratories, navy yards, arsenals, and missile launching sites and in hospitals and schools run by the military services.

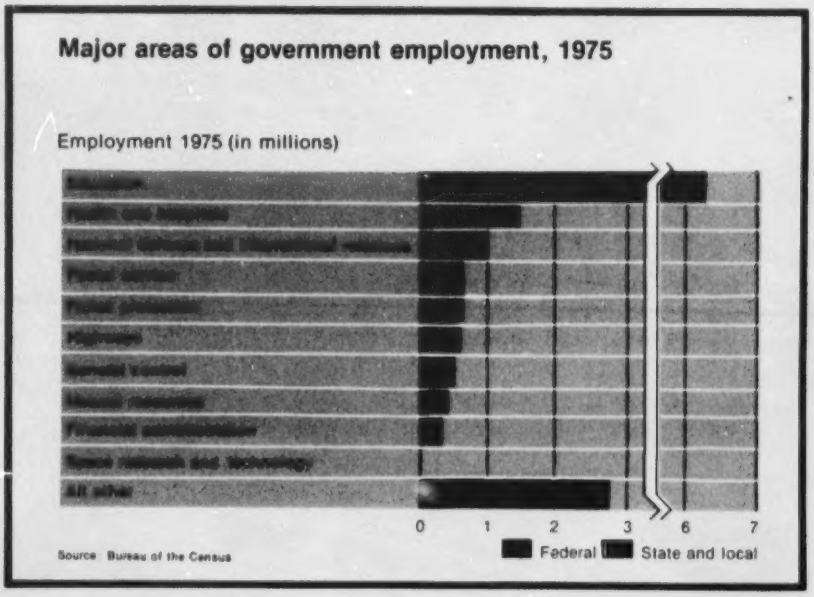


Table 1. Percent distribution of employment in government and private industry by occupation, 1976

Occupation	Government [1]	Private industry
Total	100	100
White-collar workers	68	46
Professional and technical	36	11
Managers and administrators	8	10
Clerical	24	18
Sales	(2)	7
Blue-collar workers	14	39
Craft and related workers	6	14
Transport equipment operatives	3	4
Other equipment operatives	1	15
Nonfarm laborers	4	6
Service workers	18	13
Farm workers	(2)	2

[1] Excludes Federal employment overseas.
[2] Less than 0.5 percent
NOTE: Because of rounding, sums of individual items may not equal totals.
SOURCE: Bureau of Labor Statistics

Another 1.4 million workers provided health services and staffed hospitals, primarily for State and local governments. Many workers also were employed in housing and community development, police and fire protection, social security and public welfare services, transportation and public utilities, financial administration, general administrative functions, and judicial and legislative activities. The majority of these workers also were State and local government employees. All of the 700,000 government workers in postal services and a majority of the 400,000 workers in natural resources, such as those in National Park and Forest Services, were employed by the Federal Government.

Because of the special character of many government activities, the occupational distribution of employment is very different from that in private industry, as shown in table 1.

Although the many government activities require a diversified work force having various levels of education, training, and skill, 2 out of 3 government employees are white-collar workers. Among the largest white-collar occupational groups are teachers, administrators, postal clerks, and office workers such as stenographers, typists, and clerks.

Some important service, craft, and manual occupations are aircraft and automotive mechanics, repairers, police officers, firefighters, truckdrivers, skilled maintenance workers (for example, carpenters, painters, plumbers, and electricians), custodial workers, and laborers.

The following chapters discuss opportunities for civilian employment in the major divisions of government and in the various branches of the Armed Forces. A separate chapter gives information on post office occupations.

FEDERAL CIVILIAN GOVERNMENT

Nature and Location of Employment

The Federal Government is the Nation's largest employer. It employed about 2,750,000 civilian workers in 1976, including about 50,000 U.S. citizens in U.S. territories and foreign countries. Although the headquarters of most Government departments and agencies are in the Washington, D.C. metropolitan area, only 1 out of 8 (about 350,000) Federal employees worked in that area in 1976. Nearly 300,000 worked in California, and more than 100,000 each in New York, Pennsylvania, Texas, and Illinois.

Federal employees work in occupations that represent nearly every kind of job in private employment, as well as some others unique to the Federal Government, such as postal clerk, regulatory inspector, foreign service officer, and Internal Revenue agent. Most Federal employees work for the departments and agencies that make up the executive branch of the government. About 50,000 are employed in the legislative and judicial branches.

The executive branch includes the Executive Office of the President, the 11 cabinet departments, and nearly 90 independent agencies, commissions, and boards. This branch is responsible for activities such as administering Federal laws, handling international relations, conserving natural resources, treating and rehabilitating disabled veterans, delivering the mail, conducting scientific research, maintaining the flow of supplies to the Armed Forces, and administering other programs to promote the health and welfare of the people of the United States.

The Department of Defense, which includes the Departments of the Army, Navy, and Air Force, is the largest agency. It employed over 930,000 civilian workers in 1976. The departments of Agriculture; Health, Education, and Welfare; and Treasury each employed more than 100,000 workers. The two largest independent agencies were the U.S. Postal Service, which employed 680,000 workers, and the Veterans Administration, which employed over 200,000.

Nearly 40,000 people worked for the legislative branch of government, which includes the Congress, the Government Printing Office, the General Accounting Office, and the Library of Congress. More than 10,000 people worked for the judicial branch, which includes the Supreme Court and the other U.S. courts.

White-Collar Occupations. Because of its wide range of responsibilities, the Federal Government employs white-collar workers in a great many occupational fields. Nearly 2 million white-collar workers, including postal workers, worked for the Federal Government in 1975. About 1 out of 4 of these were administrative and clerical workers.

More than 470,000 general clerical workers were employed in all departments and agencies of the Federal Government in 1975. Included in this group were office machine operators, secretaries, stenographers, clerk-typists, mail and file clerks, telephone operators, and workers in computer and related occupations. In addition, there were over 500,000 postal clerks and mail carriers employed by the Federal Government.

About 150,000 Federal Government workers were employed in engineering and related fields in 1975. Included in this total were about 80,000 engineers, representing virtually every branch and specialty of the profession. There also were large numbers of technicians in areas such as engineering, electronics, surveying, and drafting. Nearly two-thirds of all engineers were in the Department of Defense.

Of the 120,000 workers employed in accounting and budgeting work, 35,000 were professional accountants or Internal Revenue agents. Among technician and administrative occupations in this field were accounting technician, tax accounting technician, and budget administrator. There also were large numbers of clerks in specialized accounting work. Accounting workers were employed throughout the Government, particularly in the Department of Defense, the Treasury Department, and the General Accounting Office.

Nearly 120,000 Federal employees worked in hospitals or in medical, dental, and public health activities in 1975. Three out of 5 were either professional nurses or nursing assistants. Professional occupations in this field included physician, dietitian, medical technologist, and physical therapist. Other technician and aide jobs were medical technician, medical laboratory aide, and dental assistant. Employees in this field worked primarily for the Veterans Administration; others worked for the Departments of Defense and Health, Education, and Welfare.

Almost 70,000 workers were engaged in administrative work related to private business and industry. They arranged and monitored contracts with the private sector, and purchased goods and services needed by the Federal Government. Administrative occupations included contract and procurement specialist, production control specialist, and Internal Revenue officer. Two out of three of these workers were employed by the Departments of Defense and Treasury.

Another 60,000 persons worked in jobs concerned with the purchase, cataloging, storage, and distribution of supplies for the Federal Government. This field included many managerial and administrative positions such as supply management officer, purchasing officer, and inventory management specialist, as well as large numbers of specialized clerical

positions. Most of these jobs were in the Department of Defense.

The Federal Government employed almost 60,000 persons in the field of law. There were about 17,000 employees in professional positions, such as attorney or law clerk, and administrative positions such as passport and visa examiner or tax law specialist. There also were many clerical positions that involve claims examining work. Workers in the legal field were employed throughout the Federal Government.

About 50,000 persons were employed in the social science field. Professional economists were employed throughout the Federal Government; psychologists and social workers worked primarily for the Veterans Administration; and foreign affairs and international relations specialists for the Department of State. One third of the workers in this field were social insurance administrators, employed largely in the Department of Health, Education, and Welfare.

About 45,000 biological and agricultural science workers were employed by the Federal Government. Many of these worked in forestry and soil conservation activities. Others administered farm assistance programs. The largest number were employed as biology, forest and range fire control, soil conservation, and forestry technicians. Most of these workers were employed by the Departments of Agriculture and Interior.

The Federal Government employed about 45,000 persons in investigative and inspection work. Large numbers of these workers were engaged in criminal investigation and health and regulatory inspection. Most of these jobs were in the Departments of Treasury, Justice, and Agriculture.

In the physical sciences, the Federal Government employed more than 40,000 persons. Professional workers included chemists, physicists, meteorologists, cartographers, and geologists. Aides and technicians in this field included physical science technicians, meteorological technicians, and cartographer's technicians. Three out of four workers in the physical sciences were employed by the Departments of Defense, Interior, and Commerce.

Among the 15,000 persons employed in the mathematics field were professional mathematicians and statisticians, and mathematics technicians and statistical clerks. Mathematics workers were employed primarily by the Departments of Defense, Agriculture, Commerce, and Health, Education, and Welfare.

Entrance requirements for white-collar jobs vary widely. Entrants into professional occupations usually must have a college degree in a specified field or equivalent work experience. Occupations typical of this group are attorney, physicist, and engineer.

Entrants into administrative and managerial occupations usually are not required to have knowledge of a specialized field, but rather must indicate that they have potential for future development by having a degree from a 4-year college or responsible job experience. Entrants usually begin at a trainee level and learn the duties of the job after they are hired. Typical jobs in this group are budget analyst, claims examiner, purchasing specialist, administrative assistant, and personnel specialist.

Technician, clerical, and aide-assistant jobs have entry level positions that usually are filled by people who have a high school education or the equivalent. For many of these positions, no previous experience or training is required. The entry level position is usually that of trainee. Persons who have junior college or technical school training, or those who have specialized skills, may enter these occupations at higher levels. Jobs typical of this group are engineering technician, supply clerk, clerk-typist, and nursing assistant.

Blue-Collar Occupations. Blue-collar occupations—service, craft, operative and laborer jobs—provided employment for more than 520,000 workers in 1975. The Department of Defense employed about three-fourths of these workers in establishments such as naval shipyards, arsenals, and air or army depots, as well as on construction, harbor, flood-control, irrigation, or reclamation projects. Others worked for the Veterans Administration, U.S. Postal Service, General Services Administration, Department of the Interior, and Tennessee Valley Authority.

The largest single group of blue-collar workers consisted of mobile equipment operators and mechanics. These jobs included those of forklift operator, chauffeur, truckdriver, and automobile mechanic. The second largest group of workers consisted of general laborers, who performed a wide variety of manual jobs.

The Federal Government employed many workers in machinery operation and repair occupations, such as boiler and steam plant operator, machinist, machinery repairer, maintenance electrician, electronics equipment repairer, and aircraft mechanic.

Skilled construction workers also were utilized widely throughout the Federal Government in such jobs as carpenter, painter, plumber, steamfitter and pipefitter, and sheet-metal worker. Other important blue-collar occupations included warehouse worker, food service worker, and printer.

Entrance requirements. Persons with previous training in a skilled trade may apply for a position with the Federal Government at the journeyman level. Those with no previous training may apply for appointment to one of several apprenticeship programs. Applicants are given a written examination and are rated on their potential for learning a skilled trade. Apprenticeship programs generally last for 4 years; trainees receive both classroom and on-the-job training. After completing this training, a person is eligible for a position at the journey level. There also are a number of positions which require little or no prior training or experience, including custodian, maintenance worker, messenger, and many others. (Detailed descriptions of the work duties, qualifications, and training of most white-collar, service, craft, and laborer jobs mentioned above are provided in other sections of the *Handbook*.)

The Merit System

More than 9 out of 10 jobs in the Federal Government are under a merit system. The Civil Service Act,

administered by the U.S. Civil Service Commission, covers 6 out of 10 Federal jobs. This act was passed by the Congress to insure that Federal employees are hired on the basis of individual merit and fitness. It provides for competitive examinations and the selection of new employees from among those who make the highest scores. The commission, through its network of about 100 Federal Job Information Centers, examines and rates applicants and supplies Federal departments and agencies with names of persons eligible for the jobs to be filled.

Some Federal jobs are exempt from Civil Service requirements, either by law or by action of the Civil Service Commission. However, most of these positions are covered by separate merit systems of other agencies such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Energy Research and Development Administration, the Nuclear Regulatory Commission, and the Tennessee Valley Authority.

Civil service competitive examinations may be taken by any U.S. citizen. To be eligible for appointment, an applicant must meet minimum age, training, and experience requirements for the particular job. A physical handicap will not in itself bar a person from a position if it does not interfere with his or her performance of the required duties. Examinations vary according to the types of positions for which they are held. Some examinations test the applicant's ability to do the job applied for or his or her ability to learn how to do it. Applicants for jobs that do not require a written test are rated on the basis of the experience and training described in their applications and any supporting evidence required.

Applicants are notified as to whether they have achieved eligible or ineligible ratings, and the names of eligible applicants are entered on a list in the order of their test scores. When a Federal agency requests names of eligible applicants for a job vacancy, the area office sends the agency the names at the top any one of the top three. Names of those not selected are restored to the list for consideration for other job openings.

Employment Trends and Outlook

Federal employment is expected to grow more slowly than the average for all industries through the mid-1980's, continuing a trend begun in the late 1960's. Although total Federal Government employment is expected to rise somewhat, some Federal agencies will reduce their staffs as some administrative responsibilities will continue to be transferred to State and local governments. In addition, the Postal Service is expected to reduce staff while the Department of Defense is expected to keep the number of its civilian employees relatively constant.

In addition to some new jobs there will be openings due to the need to replace employees who transfer out of the Federal service, retire, or die. Thus, many job opportunities will occur in occupations where total employment is relatively stable, as well as in those in which it is rising.

The proportion of Federal workers employed in professional, technical, and administrative jobs has gradually increased in recent years and the proportion employed in clerical and blue-collar jobs has fallen. This trend is expected to continue, reflecting the increasing demand for existing services by a growing population, as well as demands for new services. Acceptance of new or redefined responsibilities by the Federal Government is expected to result in rising requirements for professional, administrative, and technical workers. Employment in many clerical and blue-collar occupations will be limited by the Federal Government's increasing use of laborsaving electronic data processing and materials handling equipment and the introduction of improved data transmission and communications systems.

Earnings, Advancement, and Working Conditions

Most Federal civilian employees are paid according to one of three major pay systems; the General Pay Schedule, the wage system, and the Postal Service Schedule. (The Postal Service Schedule is discussed in the statement on the Postal Service elsewhere in the *Handbook*.)

Nearly half of all Federal workers are paid under the General Schedule. The General Schedule is a pay scale for workers in professional, administrative, technical, and clerical jobs, and for workers such as guards and messengers. General Schedule jobs are classified by the U.S. Civil Service Commission in one of 18 grades, according to the difficulty of duties and responsibilities, and the knowledge, experience, and skills required of the worker. General Schedule (GS) pay rates are set by Congress and apply nationwide. They are reviewed annually to insure that they remain comparable with salaries in private industry.

The distribution of Federal white-collar employees by General Schedule grade, the entrance and maximum salaries for each grade, and the amount of each grade's periodic increases are listed in table 1. Appointments usually are made at the minimum rate of the salary range for the appropriate grade. However, appointments in hard-to-fill positions may be at a higher rate.

Employees in all grades except the highest, GS-18, receive within-grade pay increases after they have worked the required time period, if their work is at an acceptable level of competence. Within-grade increases may be given also in recognition of high-quality service.

High school graduates who have no related work experience usually start in GS-2 jobs, but some who have special skills begin at grade GS-3. Graduates of 2-year junior colleges and technical schools often can begin at the GS-4 level. Most people appointed to professional and administrative jobs such as psychologist, statistician, economist, writer and editor, budget analyst, accountant, and physicist, can enter at grades GS-5 or GS-7, depending on their academic record. Those who have a master's degree, or the equivalent education or experience, usually enter at the GS-9 or GS-11 level. Advancement to higher grades generally depends upon ability, work performance, and openings in jobs with higher grades.

Table 1. Distribution of full-time Federal employees under the General Schedule by grade level, March 31, 1976, and salary scale effective February 20, 1977

General Schedule	Employees		Salaries		
	Number	Percent	Entrance	Periodic increase	Maximum
Total all grades	1,358,489	100.0			
1	2,256	0.2	$5,810	$194	$7,556
2	25,526	1.9	6,572	219	8,543
3	99,330	7.3	7,408	247	9,631
4	174,146	12.8	8,316	277	10,809
5	182,211	13.4	9,303	310	12,093
6	85,741	6.3	10,370	346	13,484
7	127,553	9.4	11,523	384	14,979
8	27,790	2.0	12,763	425	16,588
9	139,334	10.3	14,097	470	18,327
10	22,090	1.6	15,524	517	20,177
11	146,954	10.8	17,056	569	22,177
12	139,692	10.3	20,442	681	26,571
13	107,310	7.9	24,308	810	31,598
14	49,379	3.6	28,725	958	37,347
15	24,530	1.8	33,789	1,126	[2] 43,923
16	3,309	0.2	39,629	1,321	[2] 47,500
17	990	0.1	46,423	—	[2] 47,500
18	348	[1]	[2] 47,500	—	—

[1] Less than 0.05 percent

[2] The rate of basic pay for employees at these rates is limited by section 5308 of title 5 of the United States Code to $47,500 as of the above date.

SOURCE: U.S. Civil Service Commission.

Table 2. Coordinated Federal Wage System average salaries for selected occupational groups, October 31, 1975

Occupational group	Average Salary
Manual labor	$9,895
Mobile industrial equipment operation and maintenance	12,942
Fixed industrial equipment operation and maintenance	13,607
Warehousing	11,558
Metal work and processing	13,676
Aircraft repair, propeller work, and engine overhaul	13,712
Electrical installation and maintenance	14,052
Machine tool work	13,660
Electronic equipment installation, maintenance, and operation	14,198
Woodworking	13,271
Pipefitting	13,786
Printing and reproduction	14,339
Painting and paperhanging	13,006

SOURCE: U.S. Civil Service Commission.

About one-quarter of the Federal civilian workers are paid according to the coordinated Federal Wage System. Under this system, craft, service, and manual workers are paid hourly rates which are established on the basis of "prevailing" rates paid by private employers for similar work in the same locations. As a result, the Federal Government wage rate paid for an occupation varies by locality. Average salaries paid Federal workers for some of the more common types of blue-collar work appear in table 2.

Federal Government employees work a standard 40-hour week. Employees who are required to work overtime receive premium rates for the additional time or compensatory time off at a later date. Most employees work 8 hours a day and 5 days a week, Monday through Friday, but in some cases, the nature of the work requires a different workweek. Annual earnings for most full-time Federal workers are not affected by seasonal factors.

Federal employees earn 13 days of annual (vacation) leave each year during their first 3 years of service; 20 days each year until the end of 15 years; after 15 years, 26 days each year. Nine paid holidays are observed annually. Workers who are members of military reserve organizations also are granted up to 15 days of paid military leave a year for training purposes. A Federal worker who is laid off is entitled to unemployment compensation similar to that provided for employees in private industry.

Other benefits available to most Federal employees include: A contributory retirement system, optional participation in low-cost group life and health insurance programs which are partly supported by the Government, and training programs to develop maximum job proficiency and help workers achieve their highest potential. These training programs may be conducted in Government facilities or in private educational facilities at Government expense.

Sources of Additional Information

Information on employment opportunities in the Federal Government is available from a number of sources. High school students are often able to get information from their high school guidance counselors. A college placement office is often a good source of such information for college students. Information also may be available from State employment service offices.

The U.S. Civil Service Commission operates 62 area offices and over 100 Federal Job Information Centers located in various large cities throughout the country. These offices announce and conduct examinations required for various Federal Government jobs. They evaluate qualifications and refer eligible applicants to employing agencies for their geographic areas. They also provide a complete one-stop information ser-

vice on local and nationwide job opportunities in the Federal Government service. The Federal Job Information Centers also operate a toll-free telephone information service in nearly all States for those unable to visit them. Their telephone numbers are listed in most telephone books under "U.S. Government."

For information about jobs in a specific agency, contact the agency directly.

OCCUPATIONS IN THE POSTAL SERVICE

The U.S. Postal Service handled about 90 billion pieces of mail in 1976, including letters, magazines, and parcels. About 630,000 workers were required to process and deliver this mail. The vast majority of Postal Service jobs are open to workers with 4 years of high school or less. The work is steady, and the pay starts at about $12,000 a year for most workers. Some of the jobs, such as mail carrier, offer a good deal of personal freedom. Other jobs, however, are more closely supervised and more routine.

Nature and Location of the Industry

Most people are familiar with the duties of the mail carrier, yet few are aware of the many different tasks required in processing mail and of the variety of occupations in the Postal Service.

At all hours of the day and night, a steady stream of letters, packages, magazines, and papers moves through the postal system. Mail carriers collect mail from neighborhood mailboxes and bring it to post offices that truck it to the nearest mail processing center for sorting by postal clerks. There are more than 300 large mail processing centers, each responsible for sorting the outgoing and incoming mail for an area of the United States. Outgoing mail is sorted and sent by truck or airplane to the appropriate mail processing center in another area of the country. Incoming mail is sorted for the various local post offices in the area, trucked to the post offices, and then sorted again for delivery by mail carriers to homes and business establishments. (Detailed information on mail carriers and postal clerks appears elsewhere in the *Handbook*.)

Mailhandlers load, unload, and move mail sacks and bulk mail, such as parcels and packages. They separate and distribute mail sacks to postal clerks for processing. Some also rewrap parcels and packages or operate canceling machines, fork-lift trucks, or addressograph and mimeograph machines.

Technicians and mechanics maintain, test, repair, and overhaul machinery that processes mail or dispenses stamps. Some technicians specialize in maintenance of electronic equipment.

To keep buildings and equipment clean and in good working order, the Postal Service employs a variety of service and maintenance workers. Included are janitors, laborers, vehicle mechanics, electricians, carpenters, and painters.

Postal inspectors audit post offices' operations to see that they are run efficiently, that funds are spent properly, and that postal laws and regulations are observed. They also investigate crimes such as theft, forgery, and fraud involving use of the mail.

Postmasters and line supervisors are responsible for the day-to-day operation of the post office. They supervise mailhandlers, clerks, carriers, and technicians; hire and train employees; and set up work schedules. Postmasters manage a post office, station, or branch.

More than 9 out of 10 postal workers were employed in 1 of 5 occupations in 1976. The 270,000 postal clerks and 250,000 mail carriers together accounted for 3 out of 4 postal jobs. The 40,000 mailhandlers, 40,000 line supervisors, and 30,000 postmasters were the next largest postal occupations. The postal service also employs many postal inspectors, guards, truckdrivers, administrative workers, and secretaries.

The Postal Service operates more than 40,000 post offices, stations and branches, community post offices,

Many postal service jobs do not require formal education or special training.

and contract postal stations and branches. They range in size from the large metropolitan postal station that employes hundreds of workers, to the small contract station or branch that occupies a corner of a country store. Most are post offices, but some postal facilities serve special purposes, such as handling payroll records or supplying equipment.

Although every community receives mail service, employment is concentrated in large metropolitan areas. Post offices in cities such as New York, Chicago, and Los Angeles employ a great number of workers not only because they process huge amounts of mail for their own populations but also because they serve as mail processing points for the smaller communities that surround them.

The Postal Service also contracts with private businesses to transport mail. In 1976, there were more than 12,000 of these "Star" route contracts. Most "Star" route carriers use trucks to haul mail, but some use airplanes or boats instead.

Training, Other Qualifications, and Advancement

An applicant for a Postal Service job must pass a written examination and meet minimum age requirements. Generally, the minimum age is 18, but a high school graduate may begin work at 16 if the job is not hazardous and does not require use of a motor vehicle. Many Postal Service jobs do not require formal education or special training. Applicants for these jobs are hired on the basis of their examination scores.

Applicants should apply at the post office where they wish to work and take the entrance examination for the job they want. Examinations for most jobs include a written test that checks an applicants vocabulary and reading ability, as well as any special abilities required, such as aptitude for remembering addresses. A physical examination is required, as well. Applicants for jobs that require strength and stamina are sometimes given a special test. For example, mailhandlers must be able to lift and carry mail sacks weighing up to 70 pounds. The names of applicants who pass the examinations are placed on a list in the order of their scores. Separate eligibility lists are maintained for each post office. Five extra points are added to the score of an honorably discharged veteran, and 10 extra points to the score of a veteran wounded in combat or disabled. When a job opens, the appointing officer chooses one of the top three applicants. Others are left on the list so that they can be considered for future openings.

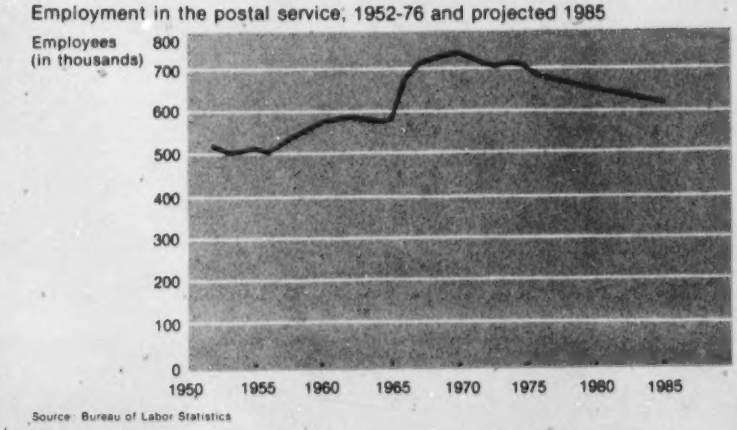
New employees are trained either on the job by supervisors and other experienced employees or in local training centers. Training ranges from a few days to several months, depending on the job. For example, mailhandlers and custodians can learn their jobs in a relatively short time while postal inspectors need months of training.

Postal workers are classified as casual, part-time flexible, part-time regular, or full-time. Casual workers are hired to help handle the large amounts of mail during the Christmas season and for other short-term assignments. Part-time flexible employees, although they have career status, do not have a regular work schedule but replace absent workers or help with extra work loads as the need arises. Part-time regulars have a set work schedule—for example, 4 hours a day. Carriers, clerks, and mailhandlers may start as part-time flexible workers and move into full-time jobs according to their seniority as vacancies occur.

Postal workers can advance to better paying positions by learning new skills. Training programs are available for low-skilled workers who wish to become technicians or mechanics. Also, employees can get preferred assignments, such as the day shift or a more desirable delivery route, as their seniority increases. When an opening occurs, eligible employees may submit written requests, called "bids," for assignment to the vacancy. The bidder who meets the qualifications for the assignment and has the most seniority gets the job.

Applicants for supervisory jobs must pass an examination. Additional requirements for promotion may include training or education, a satisfactory work record, and appropriate personal characteristics such as leadership ability. If the leading candidates are equally qualified, length of service also is considered. Although opportunities for promotion to supervisory positions in smaller post offices are limited, workers may apply for vacancies in a larger post office and thus increase their chances.

Employment in the postal service is expected to decrease due to mechanization and falling mail volume



Employment Outlook

Employment in the Postal Service is expected to decline through the mid-1980's as mail processing systems become more efficient and as mail volume falls because of rising postal rates and increasing reliance on the telephone for personal communication. Anticipated cutbacks in the frequency of home deliveries will offset any employment growth stemming from increases in the number of homes and business establishments. Consolidation of the postal system is expected to result in the closing of many small post offices reducing requirements for postmasters, guards, and maintenance and support personnel. Nevertheless, thousands of job openings will result annually as workers retire, die, or transfer to other fields.

Earnings and Working Conditions

Postal Service employees are paid under several separate pay schedules depending upon the duties of the job, knowledge, experience, or skills required. For example, there are separate schedules for production workers, such as clerks, city mail carriers, and mailhandlers; for rural carriers; for supervisors; for nonsuperisory administrative, technical, and clerical workers; and for postal executives. In all pay schedules, except that of executives, employees receive periodic "step" increases up to a specified maximum if their job performance is satisfactory. In addition, salaries of most postal workers are automatically adjusted for changes in the cost of living.

Full-time employees work an 8-hour day 5 days a week. Both full-time and part-time employees who work more than 8 hours a day or 40 hours a week receive overtime pay of one-and-one-half times their hourly rates. They also receive extra pay for night and Sunday work.

In 1976, postal employees earned 13 days of annual leave (vacation) during each of their first 3 years of service, including prior Federal civilian and military service; 20 days each year for 3 to 15 years of service; and 26 days after 15 years. In addition, they earned 13 days of paid sick leave a year regardless of length of service.

Other benefits include retirement and survivorship annuities, and low-cost life and health insurance programs supported in part by the Postal Service.

Most post office buildings are clean and well lighted, but some of the older ones are not. The Postal Service is in the process of replacing and remodeling its outmoded buildings, and conditions are expected to improve.

Most postal workers are members of unions and are covered by one of several negotiated bargaining agreements between the Postal Service and the unions.

Sources of Additional Information

Local post offices and State employment service offices can supply details about entrance examinations and employment opportunities in the Postal Service.

STATE AND LOCAL GOVERNMENTS

State and local governments provide a very large and expanding source of job opportunities in a wide variety of occupational fields. In 1976, about 12.2 million people worked for State and local government agencies; nearly three-fourths of these worked in units of local government, such as counties, municipalities, towns, and school districts.

Educational services account for about half of all jobs in State and local government. In 1975, about 6.3 million government employees worked in public schools, colleges, or other educational services. In addition to more than 3.5 million instructional personnel, school systems, colleges, and universities also employed 2.7 million administrative personnel, librarians, guidance counselors, nurses, dietitians, clerks, and maintenance workers. Three-fifths of these worked in elementary and secondary schools, which are administered largely by local governments. State employment in education is concentrated chiefly at the college, university, and technical school levels.

The next largest field of State and local government employment was health services. The 1.2 million workers employed in health and hospital work included physicians, nurses, medical laboratory technicians, and hospital attendants.

General governmental control and financial activities accounted for about 750,000 workers. These included chief executives and their staffs, legislative representatives, and persons employed in the administration of justice, tax enforcement and other financial work, and general administration. These functions require the services of individuals such as lawyers, judges and other court officials, city managers, property assessors, budget analysts, stenographers, and clerks.

More than 600,000 people worked in street and highway construction and maintenance. Highway workers include civil engineers, surveyors, operators of construction machinery and equipment, truckdrivers, concrete finishers, carpenters, toll collectors, and construction laborers.

Police and fire protection is another large field of employment. Over 600,000 persons were engaged in police work, including administrative, clerical, and custodial personnel, as well as uniformed and plainclothes police. Local governments employed all of the nearly 300,000 fire protection employees, as well as most of the police. One out of three firefighters was employed part time.

Other State and local government employees work in a wide variety of activities: Local utilities (such as water or electricity), transportation, natural resources, public welfare, parks and recreation, sanitation, correction, local libraries, sewage disposal, and housing and urban renewal. These activities require workers in diverse occupations such as economist, electrical engineer, electrician, pipefitter, clerk, forester, and busdriver.

Clerical, administrative, maintenance, and custodial work make up a large portion of employment in most government agencies. Among the workers involved in these activities are clerk-typists, stenographers, secretaries, office managers, fiscal and budget administrators, bookkeepers, accountants, carpenters, painters, plumbers, guards, and janitors. (Detailed discussions of most occupations in State and local governments are given elsewhere in the *Handbook*, in the sections covering the individual occupations.)

Employment Trends and Outlook

The long-range trend in State and local government employment has been steadily upward. Much of this growth results from the need to provide additional services as population increases and as people move from rural to urban areas. City development has required additional street and highway facilities; police and fire protection; and public health, sanitation, welfare, and other services. Population growth and increasing personal income have generated demand for additional and improved education, housing, health facilities, and other services. Except for employment in elementary and secondary school systems State and local government employment is expected to grow faster than the average for all industries through the mid-1980's.

A larger State and local work force also will be needed to provide improved public transportation systems, more urban planning and renewal programs, increased police protection, better measures to guard against air and water pollution, and expanded natural resource development programs. In addition, large numbers of workers will be needed to replace employees who transfer to other fields of work, retire, or die.

Federal-State programs in education, vocational training, health, and other fields will increase the needs of local and State governments for professional, administrative, and technical personnel. These will include engineers, scientists, social workers, counselors, teachers, physicians, and librarians.

Most positions in State and local governments are filled by residents of the State or locality. If shortages of particular skills exist however, it is often necessary to recruit from outside the area.

Earnings and Working Conditions

Earnings of State and local government employees vary widely, depending upon occupation and locality. Salary differences from State to State tend to reflect differences in the general wage level in various localities.

The *Handbook* statement for individual occupations often gives salary information for State and local government employment. Salary information also can be obtained from the appropriate State and local government agencies.

A majority of State and local government positions are filled through some type of formal civil service test, that is, personnel are hired and promoted on the basis of merit. In some areas, groups of employees, such as teachers and police, have separate civil service coverage for their specific groups.

Most State and local government employees are covered by retirement systems or by the Federal Social Security program. They usually work a standard week of 40 hours or less, with overtime pay or compensatory time benefits for additional hours of work.

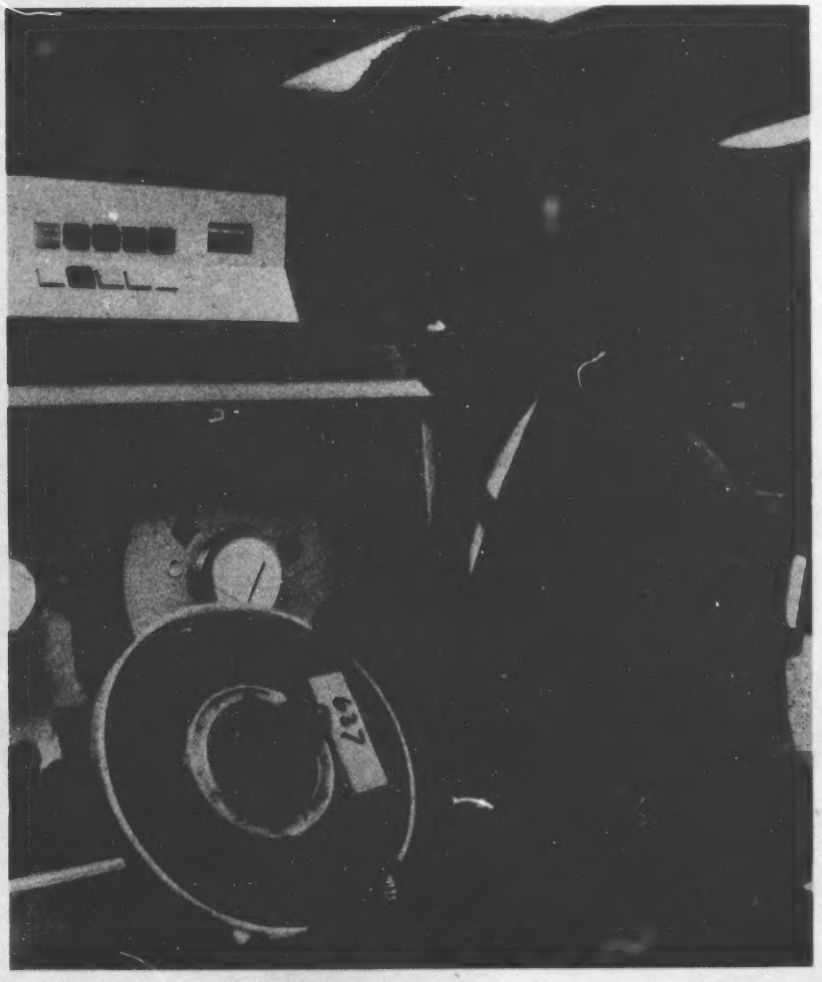
Sources of Additional Information

Persons interested in working for State or local government agencies should contact the appropriate State, county, or city agencies. Offices of local school boards, city clerks, school and college counselors or placement personnel, and local offices of State employment services have additional information.

THE ARMED FORCES

The Armed Forces offer young people career opportunities in a range of occupations almost as wide as that found in civilian life. Jobs include clerical and administrative work, skilled construction trades, electrical and electronic occupations, auto repair, and hundreds of other specialties requiring varied amounts of education and training. Each year the Armed Forces give hundreds of thousands of men and women basic and advanced training that can be useful in both military and civilian careers.

Since the draft was ended in 1973, the various branches of the Armed Forces—Army, Air Force, Navy, Marine Corps, and Coast Guard—are being staffed entirely through voluntary enlistments. The military services must compete with civilian employers, and they must offer occupational benefits and training programs that make military service an attractive career alternative. These benefits are explained in more detail later in this statement.



The Armed Forces train personnel in hundreds of different types of jobs.

A young person may enlist in any one of a variety of programs that involve different combinations of active and reserve duty. Active duty ranges from 3 to 6 years, with 3- and 4-year enlistments the most common. In general, enlistments for over 4 years are for job specialties that require a considerable amount of advanced technical training.

Places of Employment

At the end of 1976, over 2.1 million persons were on active duty in the Armed Forces—about 770,000 in the Army; 600,000 in the Air Force; 525,000 in the Navy; 190,000 in the Marine Corps; and 38,000 in the Coast Guard. In addition to those on active duty, over 2.7 million persons were in reserve components.

Military personnel are stationed throughout the United States and in many countries around the world. In the United States, the largest numbers are in California, followed by Texas, North Carolina, Florida, and the Washington, D.C. metropolitan area. About 480,000 are outside the United States. The majority of these—over 300,000—are stationed in Europe (particularly Germany); large numbers also are in the Western Pacific.

Job Training and Education for Enlisted Personnel

The Armed Forces train personnel in hundreds of different types of jobs. Job training available to enlistees depends on the length of their service commitment, their general and technical aptitude, the needs of the service, and personal preferences. Following a basic training period of between 6 and 11 weeks, depending on the service branch, a majority of the recruits go directly to formal classroom training to prepare for a specialized field of work. The remainder receive on-the-job training at their first duty assignment. For those not assigned directly to schools, there is opportunity for for-

mal classroom training following on-the-job training.

After initial or advanced training, recruits are sent to their service assignment. The type and location of duty depend on the service vacancies, personal qualifications, and personal preferences.

People planning to apply the skills they gain through military training to a civilian career should obtain certain information before choosing a military occupation. First, they should determine how good the prospects are for civilian employment in jobs related to the particular military specialty which interests them. Second, they should know what the prerequisites are for the related civilian job. Many occupations require licensing, certification, or a minimum level of education. Those who are interested should find out whether military training is sufficient to enter the field or, if not, what additional training will be required.

Much information is given in other *Handbook* statements on the employment outlook for civilian jobs for which military training helps prepare an individual. Additional information often can be obtained from schools, unions, trade associations, and other organizations in the field of interest, or from a school counselor. By looking into this kind of information before choosing a specific military occupation, young people entering the Armed Forces will help insure that the type of training they obtain will fit their career plans.

A list of major job categories for enlisted personnel is presented below.

Administrative Specialists and Clerks:

—Personnel.
—Administration.
—Clerical personnel.
—Accounting, finance, and disbursing.
—Supply and logistics.
—Religious, morale, and welfare.
—Information and education.
—Communications center operations.

Electrical and Mechanical Equipment Repairers:

—Aircraft.
—Automotive.
—Wire communications.
—Missiles, mechanical and electrical.
—Armament and munitions.
—Shipboard propulsion.
—Power generating equipment.
—Precision equipment.
—Aircraft launch equipment.
—Other mechanical and electrical equipment.

Crafts:

—Metalworking.
—Construction.
—Utilities.
—Construction equipment operation.
—Lithography.
—Industrial gas and fuel production.
—Fabric, leather and rubber.
—Firefighting and damage control.
—Other crafts.

Service and Supply Handlers:

—Food service.
—Motor transport.
—Material receipt, storage, and issue.
—Military police.
—Personal service.
—Auxiliary labor.
—Forward area equipment support.

Infantry, Gun Crews, and Seamanship Specialists:

—Infantry.
—Armor and amphibious.
—Combat engineering.
—Artillery/gunnery, rockets, and missiles.
—Combat air crew.
—Seamanship.

Electronic Equipment Repairers:

—Radio/radar.
—Fire control systems.
—Missile guidance and control.
—Sonar equipment.
—Nuclear weapons equipment.
—ADP computers.
—Teletype and cryptographic equipment.
—Other electronic equipment.

Communications and Intelligence Specialists:

—Radio and radio code.
—Sonar
—Radar and air traffic control.
—Signal intelligence/electronic warfare.
—Military intelligence.
—Combat operations control.

Medical and Dental Specialists:

—Medical care.
—Technical medical services.
—Related medical services.
—Dental care.

Other Technical and Allied Specialists:

—Photography.
—Drafting, surveying, and mapping.
—Weather.
—Ordnance disposal and diving.
—Scientific and engineering aides.
—Musicians.

A brief description of each category as it relates to civilian jobs follows:

Administrative specialist and clerk jobs are found in most private businesses and government agencies and require the same basic skills as those learned in the military services.

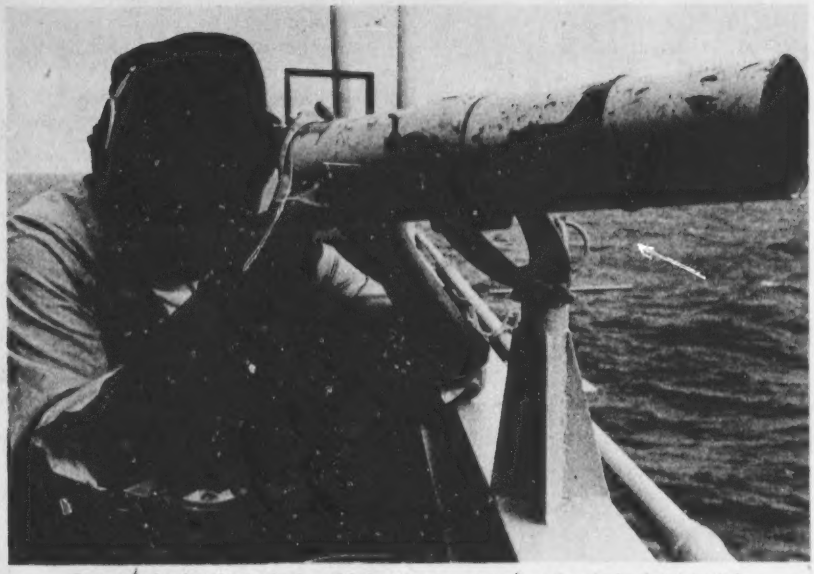
Electrical and mechanical equipment repairers generally are instructed in the basic theories and advanced troubleshooting techniques involved in the operation and repair of equipment. This instruction and training make transfer to a similar civilian job fairly easy in many career fields. In others, some additional civilian training may be needed.

In general, the various *skilled crafts or trades* require some kind of apprenticeship program. In some apprenticeship programs credit may be given for skills acquired through military training and experience.

Many of the *service and supply occupations* are identical to those in civilian life. Such military experience is helpful in obtaining similar civilian employment.

On the other hand, some of the jobs in the *infantry, gun crews and seamanship specialist* group are unique to the Armed Forces—they have few or no parallels in civilian jobs. However, this work experience may be helpful in developing leadership and supervisory skills that provide a good base for future civilian employment.

Those working as *electronic equipment repairers* generally maintain and repair specialized military equip-



Seaman looks through the ship's telescope as he stands lookout watch.

ment. However, most of the training and experience gained can be directly related to civilian occupations such as electronics technician, aircraft instrument mechanic, or radar and radio repairer. The service-trained specialist in electronic equipment repair may need additional training on specialized equipment before gaining journeyman status in civilian employment. Again, credit sometimes is given in an apprenticeship program for skills acquired in the service. For certain occupations, such as electrician, applicants for a license may be required to demonstrate their proficiency by passing an examination.

Some of the *communications and intelligence specialist* occupations have civilian counterparts; for example, sonar, radar, and radio operators may move into civilian jobs and use the same skills. In general, however, these specialists have a limited civilian demand. Other jobs, such as military intelligence or combat operations control have very few or no directly parallel civilian occupations.

In recent years, changes in military training and civilian requirements in the *medical and dental* fields have greatly increased civilian employment opportunities for service-trained personnel. An examination is required in most fields to show proficiency. Some of the civilian occupations in which service-trained individuals can become certified include: Physician's assistant; laboratory technician; emergency medical technician; medical technologist; dental assistant; nurse (most States allow service-trained personnel to take the Licensed Practical Nurse Examination; a few, the Registered Nurse Examination); and physical therapists.

Other technical and allied specialists include a wide range of jobs, many having direct civilian parallels such as photographer, meteorologist, musician, and others providing skills with limited demand in the civilian sector such as ordnance disposal and diving.

Women are eligible for and encouraged to enter all military occupational fields except those involving actual combat.

Other Educational Programs

In addition to on-duty training, a variety of programs are available to help military personnel continue their education. At most military installations, a Tuition Assistance program is available for active duty personnel who, during off-duty hours, wish to take courses.

Each service branch also offers programs for full-time education, and provides full pay allowances, tuition, and related fees. Other programs enable enlisted personnel to take college courses and additional military training so that they can become commissioned officers. Courses also are available by other institutions to help service personnel earn their high school equivalency diploma. In addition, programs are being instituted to permit the application of credit for military training courses towards associate or baccalaureate college degrees from participating institutions.

Officer Training

Officer candidates in the Armed Forces receive special training through such programs as: The Federal Service Academies (Naval, Air Force, Military, and Coast Guard); Reserve Officer Training Corps (ROTC); Officer Candidate School; National Guard (State Officer Candidate School programs); direct appointment; and several other programs.

The Federal Service Academies, which admit women as well as men, provide a 4-year college program leading to a bachelor of science degree. The midshipman or cadet is provided free room and board, tuition, medical care, and a monthly allowance. Graduates may receive regular commissions in all branches of the service and have a 5-year active duty obligation.

To become a candidate for appointment as a midshipman or cadet in the Naval, Air Force, or Military Academy, most applicants obtain a nomination from an authorized nominating source (usually a member of Congress). It is not necessary to know a member of Congress personally to request a nomination. The nominee must meet certain requirements, which include an academic record of a specified quality, college aptitude test scores above an established minimum, and recommendations from teachers or school officials. Also, the nominee must pass a medical examination. Appointments are made from eligible nominees according to personal preference of the nominating authority and by a competitive system based on the nominees' qualifications. The dependents

The Armed Forces offer a variety of flight training programs, many of which lead to a commission.

Table 1. Active duty military compensation in 1976 for members of the Armed Forces who are single and have less than 2 years of service

Pay grade	Regular military compensation, total	Basic pay	Quarters allowance	Subsistence allowance
Enlisted members:				
E-1	$6,346	$4,493	$886	$967
E-2	6,915	5,008	940	967
E-3	7,227	5,198	1,062	967
E-4	7,566	5,407	1,192	967
Commissioned officers:				
O-1	10,553	8,280	1,606	667
O-2	12,263	9,540	2,056	667
O-3	13,973	10,944	2,362	667

SOURCE: Department of Defense.

of certain veterans may automatically gain admission if they apply. Active and reserve service members also may receive such preferences.

Appointments to the Coast Guard Academy are made on a competitive basis. A nomination is not required.

The Reserve Officer Training Corps (ROTC) Program involves the training of students in about 500 Army, Navy, Marine Corps, and Air Force units at participating colleges and universities throughout the United States and Puerto Rico. As a part of the school curriculum, ROTC training includes 2 to 5 hours of military instruction a week in addition to regular college courses.

Students in the last 2 years of an ROTC program and all those on ROTC scholarships are paid a monthly allowance while attending school and receive additional pay for summer training. Following graduation, ROTC students fulfill their military obligations by serving as regular or reserve officers for a stipulated period of time.

A commission in the Armed Forces can be earned without ROTC training by those who enlist from civilian life into one of the several Officer Candidate School Programs. The Army, Navy, Air Force, Marine Corps, and Coast Guard train selected college graduates to become commissioned officers. The National Guard also has several Officer Candidate Programs for qualified high school graduates.

Many persons who are trained in medicine or one of the related health sciences may qualify for direct appointment as officers. Financial assistance is available to students enrolled in training in one of these fields. Direct appointments also are available for those qualified to serve in other special duties, such as the judge advocate general or chaplain corps.

The Armed Forces offer a wide variety of flight training programs, many of which lead to a commission. All services have programs for qualified enlisted personnel to obtain commissions.

Salary, Allowances, Promotion, and Working Conditions

In addition to a regular salary, military personnel receive free room and board, medical and dental care, a military clothing allowance, military supermarket and department store shopping privileges, recreational facilities, 30 days of paid vacation a year, and travel opportunities. When room and board are not provided, a living allowance is given. Table 1

gives examples of military pay and allowances. Career officers and enlisted personnel also are eligible for retirement benefits after 20 years of service.

The pay grades for enlisted personnel are E-1 to E-9. The pay grades for commissioned officers are O-1 to O-10.

Enlisted personnel will normally be promoted to pay grade E-3 within their first 12 months of service. Further promotions depend on individual merit, but in-grade pay increases are possible on the basis of length of service.

The normal workweek in the Armed Forces is 8 hours a day, 5 or 5 1/2 days a week. Due to the nature of military work, an individual or group may be called upon to work longer hours without additional compensation. With the wide range of jobs found in the service, working conditions vary substantially. Some jobs that are extraordinarily dangerous, or in an undesirable location, provide additional income in the form of bonuses or special payments.

Athletic and other recreational facilities—such as libraries, gymnasiums, tennis courts, golf courses, and movies—are available on most military installations. Also available are personal affairs officers, legal assistance officers, and chaplains, as well as supporting agencies, which military personnel may go to for help with personal or financial problems.

Veterans' Benefits

The Veterans Administration provides numerous benefits to those who have served in the Armed Forces. The educational assistance program usually is the most important to those considering enlisting.

Each month they are on active duty, Armed Forces personnel may set aside between $50 and $75 of their pay into an educational fund. The Veterans Administration puts in two dollars for every dollar contributed by the service member, up to a limit of $2,700 of the service member's contribution. Upon separation from active duty, the amount in the fund can be used to finance an education at any approved institution. One month of benefits is available for each month the service member contributed; a service member may receive benefits for a maximum of 36 months. Since the service member's contributions are matched 2 for 1, this means that a maximum of $8,100 may be available over the 36-month period ($2,700 paid into the fund by the service member, $5,400 by the Armed Forces). Since most colleges have about a 9 month academic year, a regular 4-year college program can be financed through this contributory arrangement. These benefits may be received for education at any approved institution, including public or private elementary, secondary, vocational, correspondence, business, or flight training schools; community or junior colleges; normal schools; teacher's colleges; colleges or universities; professional, scientific, or technical institutions; and various other institutions that furnish education at the elementary level or above.

More detailed or current information on educational benefits, as well as other veterans benefits, is available from the Veterans Administration office located in each State, the District of Columbia, Puerto Rico, and the Philippines.

Other Sources of Information

Each of the military services publishes handbooks and pamphlets that describe entrance requirements, training and advancement opportunities, and other aspects of military careers. These publications are available at all recruiting stations, most State employment service offices, high schools, colleges, and public libraries. Individuals may obtain additional information by writing to the addresses below:

U.S. Army Recruiting Command, Fort Sheridan, Ill. 60037.

Navy Recruiting Command, (Code 40), 4015 Wilson Blvd., Arlington, Va. 22203.

USAF Recruiting Service, Directorate of Recruiting Operations, Randolph Air Force Base, Tex. 78148.

Director, Personnel Procument Division, Headquarters, U.S. Marine Corps, Washington, D.C. 20380.

Commandant, (G-PMR), U.S. Coast Guard, Washington, D.C. 20590.

Dictionary of Occupational Titles (D.O.T.) Index

The fourth edition of the *Dictionary of Occupational Titles* is in print. Listed below are the fourth edition *D.O.T.* numbers that correspond to those from the third edition, which were used in the *Handbook*.

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Chemical engineers . . . 20
Chemists . . . 21
Chiropractors . . . 27
City managers . . . 30
Civil aviation industry . . . 16
Civil engineers . . . 20
Claim representatives . . . 7
Coal mining industry . . . 37
Collection workers . . . 8
College and university teachers . . . 12
College career planning and placement counselors . . . 31
College student personnel workers . . . 31
Commercial artists . . . 34
Compositors . . . 3
Computer operating personnel . . . 6
Computer service technicians . . . 6 or 25
Conductors (railroad) . . . 17
Construction inspectors (Government) . . . 11
Construction laborers . . . 14
Cooks and chefs . . . 10
Cooperative extension service workers . . . 36
Coremakers . . . 2 or 39
Correction officers . . . 11
Cosmetologists . . . 26
Credit managers . . . 8
Customer service occupations (electric power) . . . 23

Dancers . . . 33
Dental assistants . . . 28
Dental hygienists . . . 28
Dental laboratory technicians . . . 28
Dentists . . . 27
Diesel mechanics . . . 24
Dietitians . . . 32
Dining room attendants and dishwashers . . . 10
Dispensing opticians . . . 29
Display workers . . . 34
Drafters . . . 20
Drug industry . . . 38
Drywall installers and finishers . . . 15

EEG technicians . . . 29
EKG technicians . . . 29
Economists . . . 30
Electric power industry . . . 23 or 37
Electric sign repairers . . . 25
Electrical engineers . . . 20
Electricians (construction) . . . 15
Electronics industry . . . 40
Electroplaters . . . 4
Electrotypers and stereotypers . . . 3
Elevator constructors . . . 14
Emergency medical technicians . . . 29
Employment counselors . . . 31
Engineering and science technicians . . . 20

FBI special agents 11
Farm equipment mechanics 24
Federal civilian government 42
File clerks 5
Firefighters 11
Flight attendants 16
Floor covering installers 15
Floral designers 34
Food counter workers 10
Food scientists 21
Foresters ..... 19 or 36
Forestry technicians ..... 19 or 36
Forge shop occupations 2
Foundry industry ..... 2 or 39
Funeral directors and embalmers 26
Furniture upholsterers 26

Gasoline service station attendants 24
Geographers 30
Geologists 19
Geophysicists 19
Glaziers 15
Guards 11

Health and regulatory inspectors (Government) .. 11
Health services administrators 28
Historians 30
Home economists 32
Homemaker-home health aides 32
Hotel front office clerks 9
Hotel housekeepers and assistants 9
Hotel industry 9
Hotel managers and assistants 9

Industrial chemicals industry 38
Industrial designers 34
Industrial engineers 20
Industrial machinery repairers 4
Industrial traffic managers 8
Inspectors (manufacturing) 4
Instrument makers (mechanical) 2
Instrument repairers 25
Insulation workers 15
Insurance agents and brokers ..... 7 or 13
Insurance industry 7
Intercity busdrivers 18
Interior designers 34
Interpreters 35
Iron and steel industry 39
Ironworkers 14

Jewelers 26

Kindergarten and elementary school teachers 12

Landscape architects 34
Lathers 15
Laundry and drycleaning industry ..... 9 or 41
Lawyers ..... 8 or 30
Librarians 12
Library technicians and assistants 12
Licensed practical nurses 28
Life scientists 21
Line installers and cable splicers (telephone) 23
Lithographers 3
Local transit busdrivers 18
Local truckdrivers 18
Locksmiths 26
Locomotive engineers 17
Logging and lumber mill industry 36
Long distance truckdrivers 18

Machine tool operators 2
Machinists, all-round 2
Mail carriers 5
Maintenance electricians 4
Manufacturers sales workers 13
Marketing research workers 8
Mathematicians 22
Meatcutters 10
Mechanical engineers 20
Medical laboratory workers 29
Medical record administrators 29
Medical record technicians and clerks 29
Merchant marine industry 16
Merchant marine officers 16
Merchant marine sailors 16
Metallurgical engineers 20
Meteorologists 19
Millwrights 4
Mining engineers 20
Models 33
Molders ..... 2 or 39
Motion picture projectionists 25
Motor vehicle and equipment manufacturing industry 40
Motorcycle mechanics 24
Musicians 33

Newspaper reporters ..... 3 or 35
Nuclear energy field 37
Nursing aides, orderlies, and attendants 28

Occupational therapists 28
Occupational therapy assistants 28
Occupational safety and health workers 11
Oceanographers 19
Office machine and computer manufacturing industry ..... 6 or 40
Office machine operators ..... 5 or 6
Operating engineers (construction machinery operators) 14
Operating room technicians 29
Ophthalmic laboratory technicians 29
Optometric assistants 29
Optometrists 27
Osteopathic physicians 27

Painters and paperhangers 15
Paper and allied products industry 38
Park, recreation, and leisure service workers 32
Parking attendants 18
Patternmakers ..... 2 or 39

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Personnel and labor relations workers 8
Pest controllers 9
Petroleum and natural gas production and gas processing industry 37
Petroleum engineers 20
Petroleum refining industry . . . . . 37 or 38
Pharmacists 27
Photoengravers 3
Photographers . . . . . 3 or 35
Photographic laboratory occupations 3
Physical therapist assistants and aides 28
Physical therapists 28
Physicians 27
Physicists 21
Piano and organ tuners and repairers 26
Plasterers 15
Plumbers and pipefitters 14
Podiatrists 27
Police officers 11
Political scientists 30
Postal clerks 5
Postal Service 5
Power truck operators 4
Powerplant occupations (electric power) 23
Printing and publishing industry 3
Printing press operators and assistants 3
Private household workers 9
Production painters 4
Programmers . . . . . 6 or 22
Protestant ministers 31
Psychologists . . . . . 30 or 31
Public relations workers . . . . . 8 or 35
Purchasing agents 8

Rabbis 31
Radio and television announcers . . . . . 33 or 35
Radio and television broadcasting industry . . 33 or 35
Radiologic (X-ray) technologists 29
Railroad industry 17
Range managers . . . . . 19 or 36
Real estate agents and brokers 13
Receptionists 5
Registered nurses 28
Rehabilitation counselors 31
Reservation, ticket, and passenger agents 16
Respiratory therapy workers 29
Restaurants . . . . . 9 or 10
Retail food stores 10
Retail trade sales workers 13
Roman Catholic priests 31
Roofers 14
Route drivers . . . . . 13 or 18

School counselors 31
Secondary school teachers 12
Secretaries and stenographers 5
Securities sales workers 13
Setup workers (machine tools) 2
Sheet-metal workers 15
Shipping and receiving clerks 5
Shoe repairers 26
Shop trades (railroad) 17
Signal department workers (railroad) 17
Singers 33
Social scientists 30
Social service aides 32
Social workers 32
Sociologists 30
Soil conservationists . . . . . 19 or 36
Soil scientists 21
Speech pathologists and audiologists 28
State and local governments 42
State police officers 11
Station agents (railroad) 17
Stationary engineers 4
Statisticians 22
Statistical clerks 5
Stock clerks 5
Surveyors 20
Systems analysts . . . . . 6 or 22

Taxicab drivers 18
Teacher aides 12
Technical writers . . . . . 3 or 35
Telegraphers, telephoners, and tower operators (railroad) 17
Telephone and PBX installers and repairers 23
Telephone industry 23
Telephone operators 23
Television and radio service technicians 26
Textile mill products industry 41
Tilesetters 15
Tool-and-die makers 2
Track workers (railroad) 17
Transmission and distribution occupations (electric power) 23
Travel agents 13
Truck mechanics and bus mechanics 24
Trucking industry 18
Typists 5

Underwriters 7
Urban planners 34

Vending machine mechanics 25
Veterinarians 27

Waiters and waitresses 10
Waste water treatment plant operators 4
Watch repairers 26
Welders 2
Wholesale trade sales workers 13

BLS Materials Useful to Handbook Readers

Occupational Outlook Quarterly . . . a periodical to help young people, guidance counselors, education planners, and training officials keep abreast of occupational employment developments between editions of the biennial *Occupational Outlook Handbook*. The *Quarterly*, written in nontechnical language and illustrated in color, contains articles on emerging occupations, training opportunities, salary trends, career counseling programs, and the results of occupational research conducted by BLS. Price: $4 for a 1-year subscription; $1.30, single copy. (Must be ordered from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, with check made payable to the Superintendent of Documents.)

Occupational Outlook for College Graduates, 1978-79 Edition, (Bulletin 1956) . . . occupational outlook information about more than 100 jobs for which an education beyond high school is necessary or useful. The material is excerpted from the 1978-79 edition of the *Occupational Outlook Handbook*. (May be ordered from any regional office of BLS, with check made payable to the Superintendent of Documents.) Contact BLS regional office for price.

Occupational Projections and Training Data, (Bulletin 2020) . . . a report with detailed statistics on employment in 1976, projected requirements for 1985, average annual job openings 1976-85, and a summary of available statistics on the number of people completing training in each field. The bulletin discusses ways of analyzing supply and demand data for educational planning. (May be ordered from any regional office of BLS, with check made payable to the Superintendent of Documents.) Contact BLS regional office for price.

Education and Job Leaflets . . . a series of five leaflets listing jobs that require specified levels of education. Titles are:

Jobs for Which . . .
- . . . a High School Education Is Preferred, but Not Essential.
- . . . a High School Education Is Generally Required.
- . . . Apprenticeships Are Available.
- . . . Junior College, Technical Institute, or Other Specialized Training Is Usually Required.
- . . . a College Education Is Usually Required.

For each job listed, information is included on the training required and the employment outlook. (**Free** from BLS regional offices.)

Motivational Leaflets . . . a series of 11 leaflets, each discussing the types of jobs that may be available to persons with an interest or proficiency in a particular academic subject or field. (**Free** from BLS regional offices.)

Titles are:
- Thinking of a Clerical Job?
- Ecology and Your Career.
- English and Your Career.
- Foreign Languages and Your Career.
- Health Careers Without a College Degree.
- Liberal Arts and Your Career.
- Math and Your Career.
- The Outdoors and Your Career.
- Your Job as a Repairer or Mechanic.
- Science and Your Career.
- Social Science and Your Career.

Looking Ahead to a Career . . . a filmstrip with cassette sound track showing employment trends in occupations and industries. This career guidance tool explores the many aspects of the job market that a student should consider when choosing a career. (Sold only by BLS regional offices; make check payable to the Bureau of Labor Statistics.) Contact BLS regional office for price.

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